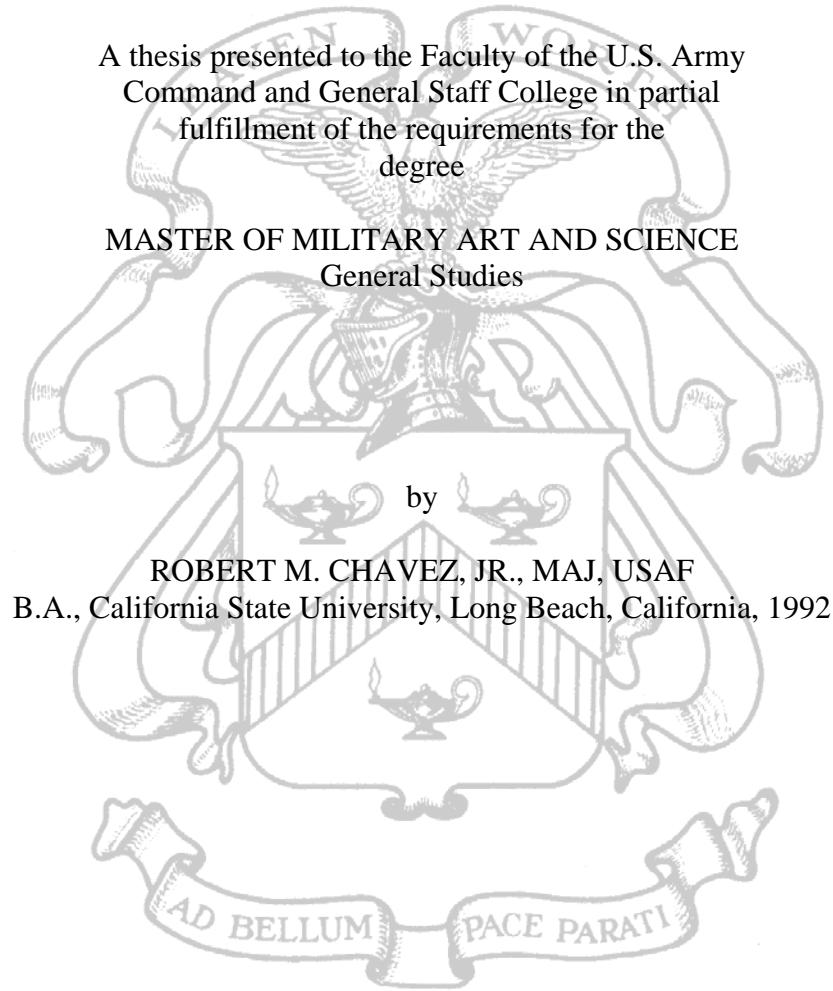


AN ANALYSIS OF THE APPLICATION OF AN EFFECTS-BASED APPROACH  
TO THE CONDUCT OF JOINT CLOSE AIR SUPPORT

A thesis presented to the Faculty of the U.S. Army  
Command and General Staff College in partial  
fulfillment of the requirements for the  
degree

MASTER OF MILITARY ART AND SCIENCE  
General Studies



ROBERT M. CHAVEZ, JR., MAJ, USAF  
B.A., California State University, Long Beach, California, 1992

Fort Leavenworth, Kansas  
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Name of Candidate: Major Robert M. Chavez Jr.

Thesis Title: An Analysis of the Application of an Effects-Based Approach to the Conduct of Joint Close Air Support

Approved by:

\_\_\_\_\_, Thesis Committee Chair  
Major Steven E. Ramer, M.S.

\_\_\_\_\_, Member  
Mr. Robert C. Garven, B.S.E.

\_\_\_\_\_, Member  
Dennis L. Dolan, Ph.D.

Accepted this 16th day of June 2006 by:

\_\_\_\_\_, Director, Graduate Degree Programs  
Robert F. Baumann, Ph.D.

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## ABSTRACT

AN ANALYSIS OF THE APPLICATION OF AN EFFECTS-BASED APPROACH TO THE CONDUCT OF JOINT CLOSE AIR SUPPORT, by Maj Robert M. Chavez, Jr., 103 pages.

Recent joint force thinking has espoused effects-based operations (EBO) as an evolutionary, some say revolutionary, approach to warfare. The 2003 *Joint Operations Concepts* document states, “The Joint Force uses an effects-based approach.” With this in mind the primary question is, Can an effects-based approach to the conduct of joint close air support (CAS) improve achievement of the supported ground commander’s intent? EBO history and theory are explored as well as the current state of joint CAS doctrine, demonstrating that EBO is conceptually well documented but effects-based ideas are just recently beginning to appear in joint publications. Current CAS doctrine presents the objective-based approach to warfare prevalent in most joint and service publications. Due to the lack of historical examples of effects-based CAS operations, the thesis uses a qualitative comparison of objective- and effects-based CAS to analyze the primary question. The analysis reveals an effects-based approach can improve achievement of the supported ground commander’s intent to some degree over the current approach and suggests that EBO is an evolutionary development of objective-based operations that should be formally incorporated into the conduct of joint CAS.

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## ACRONYMS

AFDD	Air Force Doctrine Document
ALO	Air liaison officer
AO	Area of operations
BDA	Battle damage assessment
BN	Battalion
CA	Combat assessment
CAS	Close air support
DIME	Diplomatic, informational, military, economic
EBO	Effects-based operations
EFST	Essential fire support task
ENAR	Effect, node, action, resource
FAC(A)	Forward air controller (airborne)
FM	Field Manual
IPB	Intelligence preparation of the battlespace
JFC	Joint force commander
J-FIRE	Joint firepower multi-service tactics, techniques, and procedures manual
JIPB	Joint intelligence preparation of the battlespace
JTAC	Joint terminal attack controller
JP	Joint publication
JWFC	Joint Warfighting Center
MCRP	Marine Corps reference publication
MEA	Munitions effectiveness assessment
MOE	Measure of effectiveness

MOP	Measure of performance
ONA	Operational net assessment
PBA	Predictive battlespace awareness
PMESII	Political, military, economic, social, infrastructure, information
SoSa	System of systems analysis
TPME	Task, purpose, method, effect
TTT	Tactics, techniques, and procedures
USAF	US Air Force
USJFCOM	US Joint Forces Command
USMC	US Marine Corps

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# CHAPTER 1

## INTRODUCTION

### Thesis Purpose and Chapter 1 Overview

This thesis addresses the application of effects-based operations (EBO) to the conduct of (planning, preparing, executing, and assessing) joint close air support (CAS). More than EBO, however, this study looks at an overall effects-based approach to CAS. Several questions must first be addressed before the primary research question can be posed. These are:

1. What is an effects-based approach?
2. What is CAS?
3. Why research only joint CAS processes?

This chapter provides answers to the questions posed above. Chapter 2 expands on the first preliminary question as well as several of the secondary research questions to establish a foundation for understanding the analysis. The second and third preliminary questions are addressed in chapter 1 and require no further exploration. In addition, this chapter presents the primary research question and defines the thesis scope through the secondary research questions. Finally, this chapter details the thesis significance, assumptions, key terms, limitations, and delimitations.

### Preliminary Questions

The first preliminary question is, What is an effects-based approach? To answer this question it is necessary to define EBO. The US Joint Forces Command's (USJFCOM) working definition of EBO is, "Operations that are planned, executed,

assessed, and adapted based on a holistic understanding of the **operational environment** in order to influence or change **system** behavior or capabilities using the **integrated application** of selected **instruments of power** to achieve **directed policy aims**” (Joint Warfighting Center 2004, 2). EBO is planned through the process of effects-based planning (EBP) which USJFCOM defines partially as “an operational planning process to conduct EBO . . . focus[ing] on the linkage of actions to effects to objectives” (US Joint Forces Command 2005, glossary). When effects-based planning, EBO, and the concept of effects-based assessment are combined the product is an effects-based approach to the conduct of a military operation.

The second preliminary question asks, What is close air support? CAS is a joint fire support function defined in Joint Publication (JP) 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS), Change 1*, 2 September 2005, as “air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces” (2005, ix). The key concepts in this definition are “close proximity” and “detailed integration.” As JP 3-09.3 explains, “The word ‘close’ does not imply a specific distance; rather, it is situational. **The requirement for detailed integration** because of the proximity, fires, or movement **is the determining factor**” (2005, ix). In other words, CAS is the application of aerial action against an enemy where detailed integration of air and surface forces is required.

The last preliminary question is, Why research only joint CAS processes? Since CAS is a joint function, most of the processes established in JP 3-09.3 are inherently joint, and not service-specific. Of the five chapters and five appendices comprising JP 3-

09.3, only chapter II contains service-specific information which is mostly limited to a discussion of the differences in the four services' command and control architectures.

The chapters dealing with planning, preparing, requesting, and execution, chapters III through V, are almost completely joint doctrine (JP 3-09.3 Chg 1 2005, all).

Consequently, this thesis narrows the scope of inquiry to the conduct of joint CAS, with the understanding that the results, conclusion, and recommendations apply to all the services.

#### The Primary Research Question

The primary research question is: Can an effects-based approach to the conduct of joint CAS improve achievement of the supported ground commander's intent? From this question flow two branches: (1) if yes, then how? (2) if not, then why not?

#### Scope and Secondary Research Questions

The scope of this thesis is defined by the secondary research questions which are:

1. Why try EBO at all?
2. What kind of approach to joint CAS processes is used now?
3. How is an effects-based approach applied to CAS?
4. What is a model?
5. What is supported ground commander's intent and its significance to CAS?
6. What are the definitions and relationships of links, nodes, causes, results, mechanisms, and actions in an effects-based approach?
7. What is an assessment?

8. How do intelligence preparation of the battlefield (IPB) and predictive battlespace awareness (PBA) fit into an effects-based assessment of CAS operations?

### Significance

The operational goal for transformation in the joint staff's 2003 *Joint Operations Concepts* is the idea of full spectrum dominance or "the defeat of any adversary or control of any situation across the full range of military operations" (2003, 9). To meet this challenge, that document describes how the desired future Joint Force will "organize, plan, prepare, and conduct operations" in terms of "common core capabilities" (2003, 11). The first capability is to "achieve common understanding of all the dimensions of the battlespace throughout the Joint Force" (2003, 11). Integral to the discussion of this first future common core capability is the following:

The Joint Force uses an *effects-based approach* that includes "systems visualization." Systems visualization develops a shared understanding of causal relationships and provides critical tools that assist commanders and staffs to plan, execute, assess, and adapt. It also provides some insight into potential effects beyond those that are desired [emphasis mine]. (Joint Operations Concepts 2003, 12)

The sixth future common core capability is "Disintegrate, disorient, dislocate, or destroy any opponent with a combination of lethal and non-lethal means." *Joint Operations Concepts* describes this core capability:

An integral part of joint operational planning will involve identifying and exploiting the critical relationships, dependencies, vulnerabilities, and strengths of adversary systems. An *effects-based approach*, which employs a systems methodology, is particularly applicable to an adversary system where identified links and nodes can be influenced by various instruments of national power. Such an approach may complement or supplant other approaches. The desired result for this approach is to produce specific effects that disrupt the adversary's decision making, alter intent, diminish capability and force the adversary to comply with US will [emphasis mine]. (2003, 12)

The discussion above shows the importance of determining the utility of an effects-based approach to joint CAS as part of the greater joint force transformation effort.

### Assumptions

This thesis makes the following assumptions:

1. CAS currently is a required joint force operational task (Universal Joint Task List 2002, B-C-C-59) and will continue to be required for the foreseeable future.
2. Only joint CAS processes are addressed.
3. The joint force will continue to stress effects-based approaches to military problems and solutions.
4. Preparation, normally a separate phase of operations conduct from planning, is incorporated into the planning discussion and analysis throughout.

### Key Terms

The key terms in this section establish common definitions from Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms* as amended through 31 August 2005. Complex terms or unique concepts are examined more completely in chapter 2. Effects-based approach terms have already been dealt with cursorily in this chapter and are reviewed in detail in chapter 2. Two terms mentioned earlier, predictive battlespace awareness (PBA) and intelligence preparation of the battlespace (IPB), are explored more fully in the literature review and analysis chapters. Assessment, initially defined next, is also looked at in much greater detail later in this thesis.

1. Combat Assessment (CA): The determination of the overall effectiveness of force employment during military operations. Combat assessment is composed of three major components: (1) battle damage assessment, (2) munitions effectiveness assessment, and (3) reattack recommendation.

2. Commander's Intent: A concise expression of the purpose of the operation and the desired end state that serves as the initial impetus for the planning process. It may also include the commander's assessment of the adversary commander's intent and an assessment of where and how much risk is acceptable during the operation.

3. Effect: A change to a condition, behavior, or degree of freedom.

4. End State: The set of required conditions that defines achievement of the commander's objectives.

5. Objective: The clearly defined, decisive, and attainable goals towards which every military operation should be directed.

6. Target: An area, complex, installation, force, equipment, capability, function, or behavior identified for possible action to support the commander's objectives, guidance, and intent. Targets fall into two general categories: planned and immediate.

7. Task: An action or activity (derived from an analysis of the mission and concept of operations) assigned to an individual or organization to provide a capability.

Finally, this section differentiates between the terms doctrine and tactics, techniques, and procedures (TTP). This thesis uses a combination of the joint publication hierarchy and US Air Force (USAF) definitions to distinguish between the two types of publications (Joint Doctrine Capstone and Keystone Primer 2001, 93). Doctrine is an overarching collection of generally accepted truths that "offers a common perspective

from which to plan and operate, and fundamentally shapes the way we think about and train for war" (Joint Doctrine Capstone and Keystone Primer 2001, 91). Joint doctrine is broken out into capstone and keystone publications that unify doctrinal themes and provide broad conceptual perspective. TTP are the nuts and bolts documents that detail how to actually accomplish the mission, falling below capstone and keystone doctrine in the hierarchy, but clearly linked to their superior publications (Joint Doctrine Capstone and Keystone Primer 2001, 92). Another way to look at these distinctions is that capstone and keystone doctrine present strategic and operational perspectives while TTP present the tactical view (AFDD 1 2003, 8).

### Limitations and Delimitations

The only thesis limitations are the lack of effects-based approach CAS discussion in joint doctrine and TTP and the absence of actual effects-based approach CAS case studies to examine. Due to these limitations it was necessary to explore an alternative to case study comparative analysis. Major John Harris' unpublished US Army Command and General Staff College Master of Military Art and Science thesis "Effects-Based Operations: Tactical Utility" (2004, iii) serves as a research model for analysis of effects-based approaches to tactical problems in the absence of published effects-based approach CAS doctrine, TTP, and real world effects-based CAS case study examples.

The following delimitations serve to further narrow the focus of the research and analysis:

1. Other than a brief history of effects-based approaches, the bulk of EBO discussion in this thesis is limited to theory and analysis of actual effects-based approach operations and practice.

2. Thesis research and discussion is confined to current joint doctrine, TTP, and professional journal discourse as they relate specifically to effects-based processes and CAS.

### Summary

This chapter presented the thesis purpose as the application of the emerging joint concept of EBO to the conduct of joint CAS, as well as an analysis of an overall effects-based approach to the mission.

Chapter 1 contains several preliminary questions, all leading to the primary research question: Can an effects-based approach to the conduct of joint CAS improve achievement of the supported ground commander's intent? Several secondary research questions were listed as well.

Finally, this chapter detailed the thesis significance, assumptions, key terms, limitations, and delimitations. Chapter 2, "The Literature Review," builds on the base provided in chapter 1 by presenting a brief EBO history, explaining effects-based concepts, describing the approach currently used in joint CAS processes, and describing the current status of CAS and effects-based joint doctrine and TTP.

## CHAPTER 2

### LITERATURE REVIEW

#### Overview

This chapter reviews relevant literature regarding effects-based approaches as they relate to the conduct of joint CAS. The research in this chapter briefly illustrates recent EBO history, fully defines effects-based concepts, describes the type of approach currently used in joint CAS processes, and shows the status of current effects-based and CAS joint doctrine and TTP.

Chapter 2 is organized into the following sections: EBO History; Effects-Based Concepts; Current Status of Effects-Based and CAS Joint Doctrine and Tactics, Techniques, and Procedures; and Summary.

#### EBO History

Since the appearance of the terms effects-based and EBO in the middle to late 1990s numerous writers and theorists have discussed the origins of the EBO concept. Retired USAF Colonel and noted airpower author Phillip S. Meilinger wrote that, “Airmen have always aspired to conduct effects-based operations, although they did not use that term” (2004, 116). He discusses the development of USAF and British Royal Air Force strategic bombing theory and practice from World War I through the end of World War II as the theoretical basis for EBO (2004, 117-122). USAF Major T.W. Beagle, in an effects-based study for the USAF School of Advanced Airpower Studies, supports Meilinger’s views of US and British airpower’s EBO origins by expanding the discussion to the writings and ideas of Italian Army officer and noted airpower theorist Giulio

Douhet as well (2000, 16-19). While the period of air warfare encompassed in the first half of the twentieth century is certainly the foundation for airpower's effects-based thinking, many argue militaries have always engaged in effects-based thinking and practice, even if they did not call it that.

US Army Major Leonard D. Rickerman, in his School of Advanced Military Studies monograph about EBO, sought to “dispel the notion that EBO is a new concept” (2003, 10). He did so by illustrating that effects-based ideas have always been a part of military thinking and practice although application of the concepts have been inconsistent and restricted by technological limitations (2003, 10). Militaries have always sought to achieve some kind of desired effect on the enemy, like removing his ability to fight, but have usually been constrained by the lack of technical ability to efficiently cause that desired effect short of destroying the enemy forces outright. Technological and conceptual developments in the past thirty-five years have largely changed this calculus.

In an effects-based theory monograph for the RAND Corporation, Paul K. Davis defines those technological and conceptual developments as a “*revolt of the warfighters*” (Davis 2001, 2) and illuminates the pivotal point when they occurred:

To a large extent, the EBO movement and the passion of its advocates stem from wartime experiences of young U.S. Air Force officers who were appalled by the frequently mindless and ineffective use of airpower in Vietnam. When their turn to lead came, they were determined to do better. The Gulf War was their first great opportunity and, in fact, joint fires (not just Air Force fires) were applied with decisive effectiveness as the result of sound thinking about affecting systems, not just servicing targets. Operations were dramatically different from anything previously seen. At that moment in history, a great many concepts and capabilities came together after years of evolution. (2001, 2)

Indeed, two of the principal planners of the Gulf War air campaign retired USAF Colonel John A. Warden III and USAF Major General David A. Deptula, are also two of the most

prominent progenitors and proponents of effects-based concepts (Reynolds 2005, 21).

Although it is unclear when and by whom the term EBO was first coined, Deptula is most likely the originator of the term “effects-based” when he wrote in 1995 in *Firing for Effect: Change in the Nature of Warfare* that, “The end of the Cold War and the dramatic reduction in military forces of the United States have accelerated the need for effects-based military strategy” (1995, 17).

*Firing for Effect* and its 2001 revision will likely be viewed as the seminal works on EBO theory. In *Effects-Based Operations: Change in the Nature of Warfare*, Deptula reveals the modern basis for the explosion of effects-based thinking: “The construct of warfare employed during the Gulf War air campaign has become known as *parallel warfare*, and was based upon achieving specific effects, not absolute destruction of target lists” (2001, 3). Deptula argues it was the Gulf War air planners’ application of an effects-based approach that facilitated the success of the air campaign, the parallel war concept, and the overall victory. Parallel warfare is mainly an airpower idea that Deptula now equates to the recent concept of rapid decisive operations. “The term rapid decisive operations (RDO) is a recent addition to the defense lexicon that can be used to capture the fundamental nature of the results achieved during the Gulf War. However, RDO seeks to achieve a similar result with greater rapidity and less mass. Accordingly, effects-based operations will be central to its success” (2001, 5). Rapid decisive operations never seemed to gain currency with military theorists but parallel warfare has in the USAF as has EBO in the joint world.

The EBO explosion in the joint force received critical impetus in 2001 when USJFCOM’s Concepts Department published a draft EBO white paper stating: “The

EBO concept has been developed based on insights gained from the RDO Analytic Wargame 2000 series and Unified Vision 2001, plus various limited objective experiments and other sources” (2001, i). Thus, USJFCOM set the stage for the national military leadership and joint force focus on EBO and effects-based approaches seen over the past five years.

### Effects-Based Concepts

This section is subdivided into the following areas: Definitions and Key Terms Revisited; Introduction to the Effects-Based Approach; and Effects-Based Planning, Execution, and Assessment.

#### Definitions and Key Terms Revisited

One of the classic problems with explaining any new or potentially unclear concept is settling on an agreeable definition of terms. Chapter 1 tentatively defined key terms using current definitions from Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*. Those definitions serve as a starting point for the following modifications.

USJFCOM’s current working definition of EBO is “Operations that are planned, executed, assessed, and adapted based on a holistic understanding of the **operational environment** in order to influence or change **system** behavior or capabilities using the **integrated application** of selected **instruments of power** to achieve **directed policy aims**” (Joint Warfighting Center 2004, 2). The boldfaced text is defined next based on information from pages 2 and 3 of the Joint Warfighting Center’s Doctrine Pamphlet 7, *Operational Implications of Effects-based Operations (EBO)*, 2004:

1. Effect: The physical and/or behavioral state of a political, military, economic, social, infrastructure, and information (PMESII) system that results from a military or nonmilitary action or set of actions.

2. Operational Environment: A composite of the elements, conditions, and influences that affect the employment of resources and capabilities and that bear on the decisions of the unit commander.

3. System: A functionally, physically, and/or behaviorally related group of elements that interact together as a whole. To facilitate a system-of-systems analysis (SoSa), EBO currently considers that the operational environment is comprised of PMESII systems. Analysis of these systems and their interrelationships provides the “holistic understanding” mentioned in the definition.

4. Integrated Application: The harmonized operation that results from an adaptable effects-based planning, execution, and assessment process.

5. Instruments of Power: Include all ways and means--diplomatic, informational, military, economic (DIME), and others--available to the president of the US to influence the operational environment.

6. Directed Policy Aims: The president’s objectives that comprise the desired national end state relevant to the operation at hand.

#### Introduction to the Effects-Based Approach

USJFCOM defines an effects-based approach as a methodology wherein “operations are planned, executed, assessed, and adapted based on a holistic understanding of the operational environment. They influence or change PMESII system

behaviors or capabilities through the integrated application of selected instruments of power to achieve directed policy aims” (Joint Warfighting Center 2004, 6). The key to this definition is in the idea of influencing or changing system behaviors or capabilities. This is unique to an effects-based approach and is distinct from current joint force approaches to operations.

To fully appreciate an effects-based approach to war it is necessary to first understand how the joint force approaches operations today. The current approach to joint war planning and execution is known as the strategy-to-task or objective-based approach developed by Glenn A. Kent in conjunction with the RAND corporation in the late 1980s (Mann et al. 2002, 45 and McCrabb 2001, 33). Due to its incorporation in doctrine and TTP most military professionals are familiar with the fundamentals of this approach even if they do not know its name.

When examining the objective-based approach it is helpful to revisit the joint definition of the term “objective”: “the clearly defined, decisive, and attainable goals towards which every military operation should be directed.” The objective-based approach is based on the idea that objectives are created at each level of war--strategic, operational, and tactical--and that each subordinate objective flows from higher and drives tasks specific to that level’s objectives. In other words, “Each level should have a clear set of objectives which, through certain mechanisms, form a strategy for that particular level. Objectives normally are derived from the objectives at the next higher level of war and may devolve from higher-level strategies” (Mann et al. 2002, 45). This is the approach to strategy, operational and tactical art, and the associated derivation of

objectives and tasks used throughout the joint force. The best depiction of the objective-based approach is shown in figure 1.

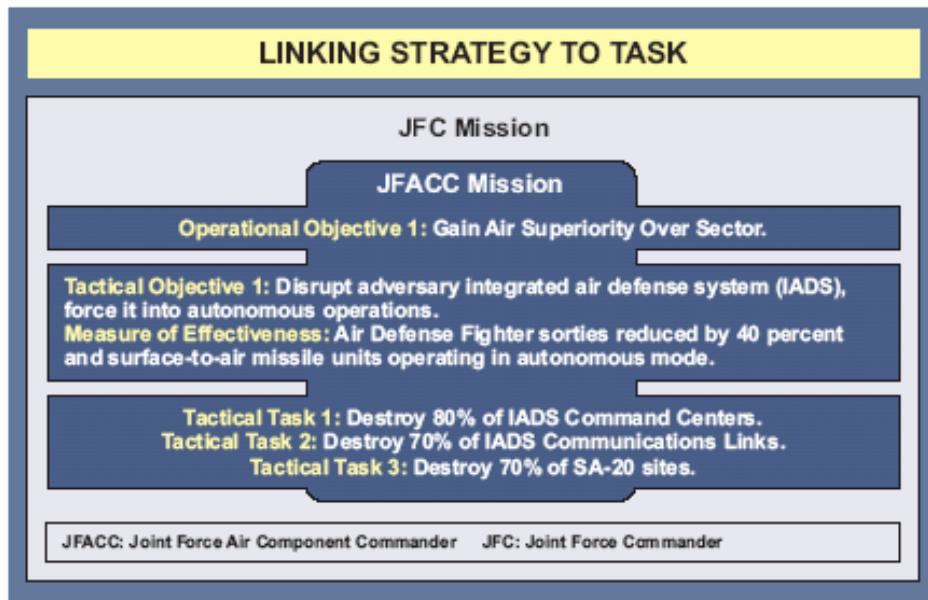


Figure 1. Example of Objective-based Strategy to Task Linkage  
Source: JP 3-30, *Command and Control for Joint Air Operations* (Washington, DC: Pentagon, 5 June 2003), III-10.

Joint force personnel are already familiar with the components depicted in figure 1 in terms of the objectives and tasks presented in operations plans or orders and the objectives and targeting guidance in air tasking orders. One can see in figure 1 that the idea of effectiveness or “effects” is already present to some degree in joint doctrine. USJFCOM recognized this connection from the onset of its development of effects-based concepts:

Understanding where effects fit into a traditional objectives-based approach is key in understanding the value of conducting operations from an effects-based perspective. An objectives-based approach relates clearly stated objectives to proposed actions, and then refines the relationship in operational

plans through a strategy-to-task linkage. An objectives-based approach focuses on the intended results or outcomes of actions, as they apply to the commander's intent. EBO takes the objectives-based approach one step further, allowing planners and commanders to examine the causal linkages and effects through which actions lead to objectives. (Concepts Department J-9 2001, ii)

For many, an effects-based approach is simply an evolution of the objective-based approach, much like objective-based methodology was an outgrowth of the traditional target-based approach common to attrition or annihilation warfare (McCabb 2005, slide 5). The connection between the three approaches to operations is depicted in figure 2.



Figure 2. Relationship of Target-, Objective-, and Effects-Based Operations  
Source: McCabb, *Effects-Based Operations: An Overview* (Maxwell AFB, AL: Air University, 2005), slide 5.

The Joint Warfighting Center (JWFC) elaborates on the effects-based approach idea stating that: "EBO is primarily about 'changing the way we think' about the operational environment and how we plan and conduct joint operations" (2004, 3). An effects-based approach also provides "improved unity of effort and integrated planning

adaptation at the operational level [and] enhanced economy of force and more precise execution at the tactical level” (JWFC 2004, 6). Finally, “an effects-based approach improves current campaign planning and assessment by emphasizing [the] linking of operational objectives to tactical-level actions through a specified set of effects” and “a more accurate, rigorous assessment of the attainment of campaign objectives focused on system behavior rather than discrete task accomplishment” (JWFC 2004, 6).

Another way of understanding the effects-based approach is by unveiling its differences from the objective-based approach:

What is most different about an effects-based operation is the calculation and articulation of the “ends.” In other words, more time and effort is spent on getting the ends right before “leaping” prematurely to ways or means. For example, the effects-based decision-making life cycle for a campaign is front-end loaded and concentrates on the formulation and refinement of “purpose,” “end states,” and “effects” more than “mission,” “specified tasks,” “courses of action,” and “force allocation.” (McDaniel 2004, 13)

Tom McDaniel’s article also makes the argument that effects-based approaches refocus planners on what really matters in operations, the desired end state. Too often with the objective-based approach planners leap into the process of planning tasks and resources without understanding the objectives and the effects required to meet those objectives (McDaniel 2004, 13). This effects-based connection of objectives, effects, and instruments of power is depicted in figure 3.

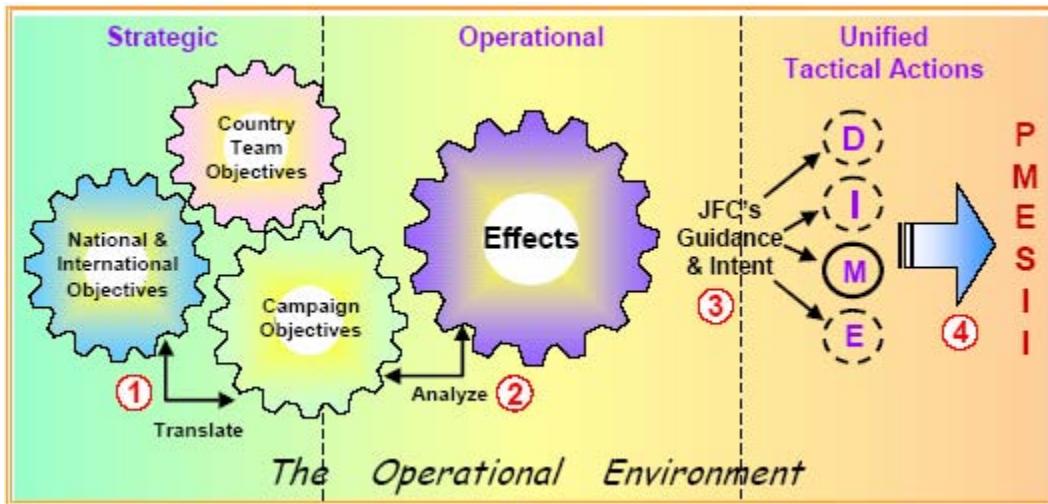


Figure 3. An Effects-Based View of the Operational Environment

Source: Joint Warfighting Center Doctrine Pamphlet 7, *Operational Implications of Effects-based Operations (EBO)* (Suffolk, VA: US Joint Forces Command, 17 November 2004), 7.

With an understanding of the overall implications of an effects-based approach, it is time to move into the nuts-and-bolts of EBO with a look at effects-based planning.

#### Effects-Based Planning, Execution, and Assessment

The discussion of effects-based planning begins with the term “intelligence,” which is defined in joint doctrine as “knowledge of the enemy” (JP 2-0 2000, v). Current joint operations develop intelligence through a process known as joint intelligence preparation of the battlespace (JIPB) (JP 2-0 2000, II-8), depicted in figure 4.

While the JIPB process is fairly self-explanatory a clarification of *battlespace effects* in Step 2 is in order. These are not effects the joint force is trying to achieve as defined earlier but are “the battlespace’s effects on friendly and enemy [courses of action]” (JP 2-0 2000, II-9).

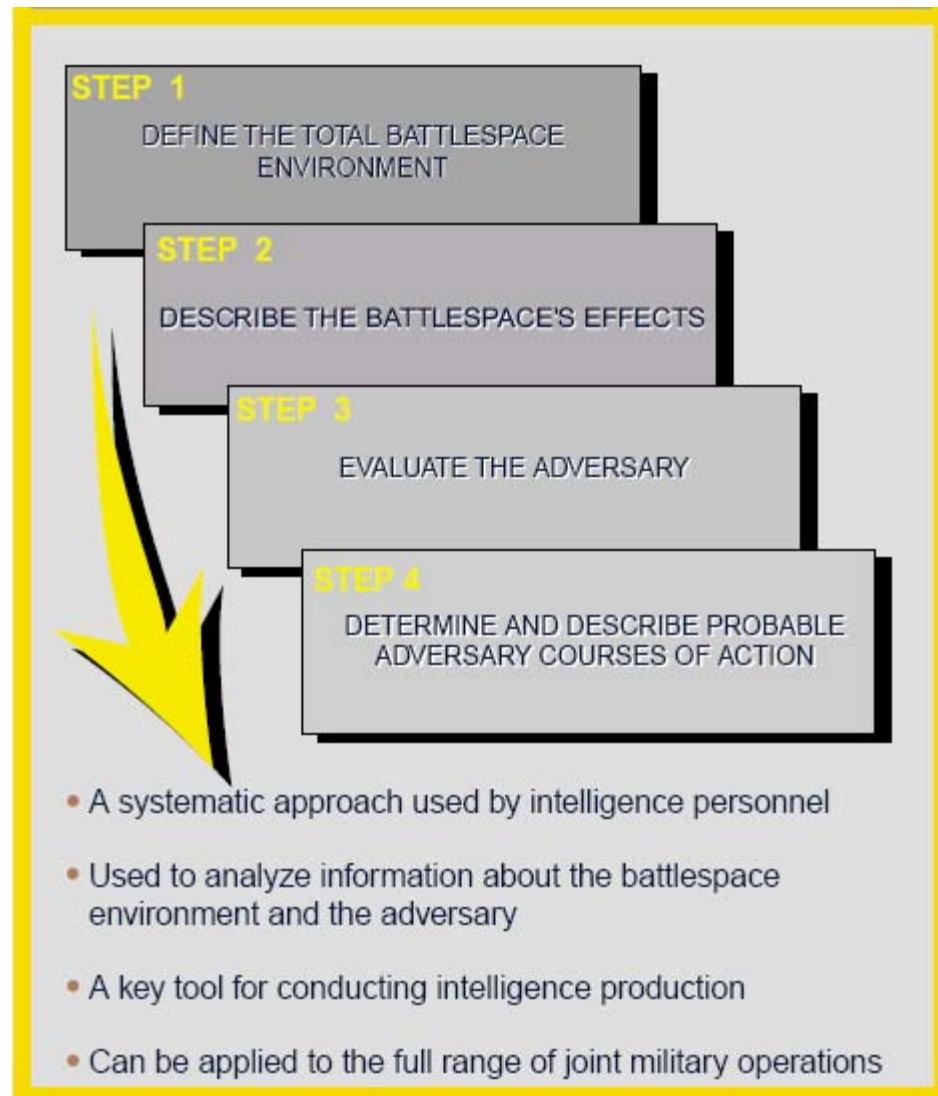


Figure 4. Joint Intelligence Preparation of the Battlespace Process

Source: Joint Staff J-2, JP 2-0, *Doctrine for Intelligence Support to Joint Operations* (Washington, DC: Pentagon, 9 March 2000), II-10.

Effects-based theory uses JIPB to receive intelligence but the joint force is emerging a new functional concept for acquiring knowledge about the enemy known as joint battlespace awareness which is described as a process that prescribes a situational knowledge whereby the [joint force commander] plans operations and executes [command and control]. It is the result of **the processing and presentation of information comprehending the operational**

**environment—the status and dispositions of friendly, adversary, and non-aligned actors; and the impacts of physical, cultural, social, political, and economic factors on military operations. Battlespace awareness provides actionable intelligence to commanders.** This capability brings to bear a responsive system that fully integrates personnel, documents, equipment, and technical means to include a constellation of highly responsive sensors (e.g., unattended, human, intrusive, and remote) providing persistent, redundant, and tailored coverage of the battlespace. (Joint Warfighting Center 2004, 5)

Joint battlespace awareness is in its infancy and will not reach its full potential until a more completely networked joint force is fielded, but it does represent an evolution of the JIPB process from simply providing knowledge of the enemy to “comprehending the operational environment,” with the goal of providing “actionable intelligence to commanders.” As such it promises the more robust situational understanding that true effects-based approaches require.

Complementing the improved intelligence promise of joint battlespace awareness are two JFWC-identified “key enablers” for EBO: operational net assessment (ONA) and system-of-systems analysis (JWFC 2004, 9 and 10).

The JWFC describes ONA as a methodology that “integrates people, processes, and tools that use multiple information sources and collaborative analysis to build a common, shared, holistic knowledge base of the operational environment. As the name implies, ONA focuses on the operational level; it consists of both process and products intended to significantly enhance both deliberate and crisis action effects-based planning” (JWFC 2004, 9). At the center of ONA is a system-of-systems approach to the enemy that “considers how to employ friendly instruments of power to achieve desired effects relative to the operational environment’s PMESII systems” (JWFC 2004, 9). ONA is an even newer idea than EBO. Realization of ONA’s potential is integral to the improvement of effects-based assessments.

System-of-systems analysis (SoSa) is essential to ONA and is the first step in that process. SoSA “populates the baseline ONA with data on PMESII systems and their organization, characteristics, and relationships. **This effort produces a nodal analysis which, along with effects development, forms the basis for coupling nodes to effects, actions to nodes, and resources to established E-N-A linkages.** Secondary and unintended effects also are considered during this process” (JWFC 2004, 10).

At this point a few additional terms need to be defined. Central to effects-based approaches is SoSa and central to that process are the terms “effects,” “nodes,” “actions,” “linkages” (also sometimes referred to as “causal linkages”), and “resources.” Figure 5 provides the JWFC definitions for these terms. Note that the definitions for “objective” and “effect” are the same as those provided earlier.

Figure 5 reveals the need to expand on the definitions of the words *effect* and *link* in terms of specific or implied categories like behavioral, physical, and functional distinctions. Joint targeting doctrine begins categorizing effects as direct, or “the immediate, first order consequence of a military action (weapons employment results, etc.), unaltered by intervening events or mechanisms,” and, indirect, or “the delayed and/or displaced second- and third-order consequences of military action” that “are often accentuated by intermediate events or mechanisms” (JP 3-60 2002, I-6). JP 3-60, *Joint Doctrine for Targeting, 2004* further categorizes effects by type and nature. Clarification of these categories is provided by Major Thomas D. Hansbarger in tables 1 and 2.

**Objective:** The clearly defined, decisive, and attainable goals toward which every military operation should be directed.

**Effect:** The physical and/or behavioral state of a PMESII system that results from a military or nonmilitary action or set of actions (DIME).

**Node:** A person, place, or physical thing that is a fundamental component of a system.

**Action:** An activity directed at a specific node.

**Resources:** The forces, material, and other assets, which can be employed to conduct an action.

**Link:** The relationship between nodes. Links can be behavioral, physical, or functional.

**Effects are created to achieve objectives.**

Figure 5. Key Effects-Based Planning Terms

Source: Joint Warfighting Center Doctrine Pamphlet 7, *Operational Implications of Effects-based Operations (EBO)* (Suffolk, VA: US Joint Forces Command, 17 November 2004), 11.

Table 1. Types of Effects

Physical	“The effects created by direct impact through physical alteration of the object or system targeted by the application of military action.”
Functional	“The direct or indirect effects of an action on the ability of a target to function properly.”
Psychological	“An action’s impact on the mental domain of a target audience.”
Systemic	“Indirect effects on the operation of a specific system or systems.”

Source: Hansbarger, *Effects-Based Targeting: Application in Operation Desert Storm and Operation Iraqi Freedom* (Fort Leavenworth KS: US Army Command and General Staff College, 18 June 2004), 16.

Table 2. Nature of Effects

Collateral	“Outcomes that result when something occurs other than intended. They may be either positive or negative as regards the original intent.”
Cascading	“Indirect effects that ripple through an enemy system, often influencing other systems as well. Typically, these effects can influence nodes critical to multiple systems. The effects may cascade upward or downward; however, most often this cascading of indirect effects flows from higher to lower levels of operations.”
Cumulative	“The effects resulting from the aggregate of many direct or indirect effects. They may occur at the same level or at different levels of employment as one achieves the contributing lower-order effects.”

Source: Hansbarger, *Effects-Based Targeting: Application in Operation Desert Storm and Operation Iraqi Freedom* (Fort Leavenworth, KS: US Army Command and General Staff College, 18 June 2004), 17.

Effects type categorization can be applied to the term *link* as well where psychological can be substituted for behavioral with no appreciable loss of meaning. Additionally, it is helpful to expand on “links,” or “causal linkages.” “Links” are critical to understanding the effects-based approach in that they describe mechanism or cause. Clarity in the reason an effect occurs, or the cause and mechanism relationship between actions and effects, helps planners predict the nature and type of effects that may result from a given action. This clarity also aids in the determination of undesirable or unintended effects or consequences, which is one of the important analytical strengths of an effects-based approach (McCrabb 2005, slides 9-13). A simple depiction of this discussion is provided in figure 6.

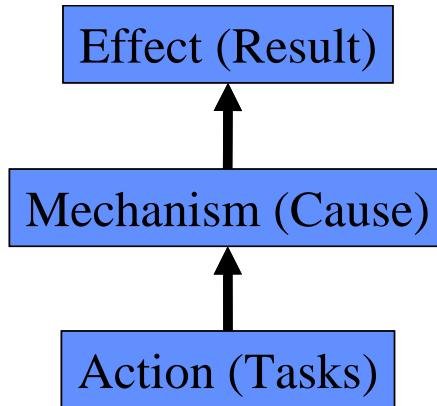


Figure 6. Relationship of Action and Effect to Mechanism (Link, Causal Link, or Node)  
 Source: McCrabb, *Effects-Based Operations: An Overview* (Maxwell AFB, AL: Air University, 2005), slide 13.

Figure 6 also shows the synonymous nature of the terms *action* and *task*, bringing the effects-based approach back toward the familiar ground of the objective-based methodology. With a clearer collection of definitions and refinements to those definitions, the SoSa concept can now be better explained.

SoSa is an analysis methodology that takes advantage of a notional model of an enemy system. A model is “a schematic description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics” (Free Dictionary 2005, model). This describes the model used for over fifteen years now by airpower planners to visualize an enemy state as a system (Warden 2005, 44) in order to determine the best ways to cause effects to achieve objectives. Colonel Warden was the originator of the enemy state five-ring model, which included leadership, organic essentials, infrastructure, population, and fielded military and which was the precursor to the SoSa model.

The JWFC built on the initial EBO ideas to create an updated system model addressing PMESII as its “rings” or essential elements. Many theorists have espoused that EBO requires a “systems” approach to analyzing the enemy. Modern EBO thinkers have taken this one step further and look at enemy entities as “systems-of-systems,” recognizing the complex nature of the structures within which the military and other elements of national power work to achieve objectives. Looking at the model depicted in figure 7, “SoSA identifies the relationship between nodes within individual systems and across systems. These nodes and associated links are then identified for DIME actions to influence or change system behavior and capabilities in order to achieve desired objectives” (JWFC 2004, 10).

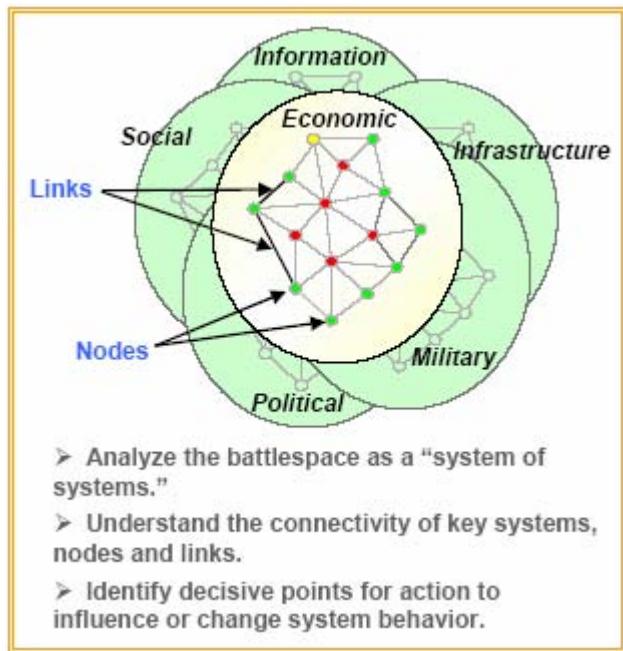


Figure 7. System-of-Systems Depiction

Source: Joint Warfighting Center Doctrine Pamphlet 7, *Operational Implications of Effects-based Operations (EBO)* (Suffolk, VA: US Joint Forces Command, 17 November 2004), 10.

Next, “planners identify actions that, when executed against specified key nodes, should achieve the desired effects. [Then], they couple the actions with specific resources or forces, **completing an effects-nodes-actions-resources (E-N-A-R) linkage**” (JWFC 2004, 12). All of this drives toward a more complete depiction of the interaction between actions, links and nodes, and effects (figure 8).

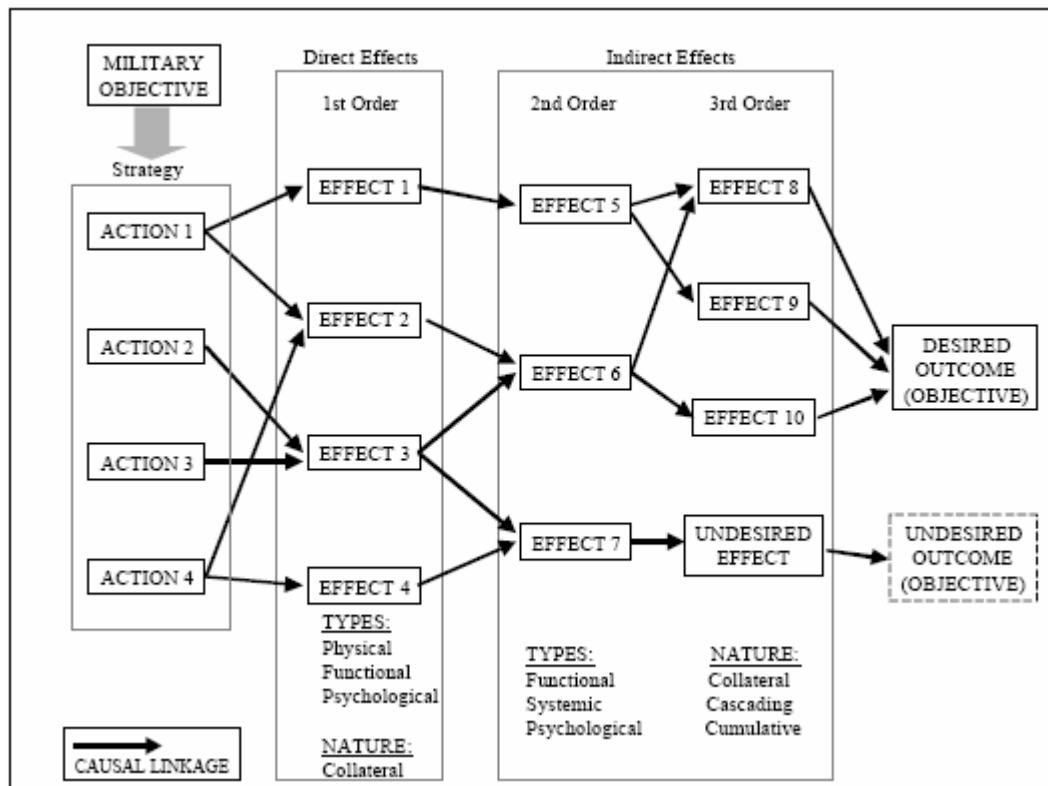


Figure 8. Effects-Based Model

Source: Hansbarger, *Effects-Based Targeting: Application in Operation Desert Storm and Operation Iraqi Freedom* (Fort Leavenworth, KS: US Army Command and General Staff College, 18 June 2004), 18.

This discussion illuminates the importance of improved intelligence processes, such as joint battlespace awareness. There are too many possibilities and permutations in

the analysis of effects to leave effects-based and systems planning to chance. In order to conduct EBO, planners and intelligence officers need to analyze all enemies, threats, and potential adversary systems using SoSa, which is a fairly dramatic evolution from JIPB but not a huge leap from the current joint targeting processes described later in this chapter.

Once effects to achieve objectives have been determined, planners identify ways to measure how well the effects are being achieved during execution. These measurements become precise, quantifiable statements known as Measures of Effectiveness (MOEs). “Planners identify MOEs for both desired and undesired effects. MOEs indicate how the PMESII system is behaving (e.g., how the adversary is acting). Indicators for each MOE are developed and feed intelligence collection planning as mission analysis and [course of action] development continues” (JWFC 2004, 13). An example of how these tie in with previously developed concepts is provided in figure 9.

Once effects and MOEs are identified to meet objectives, planners identify tasks that will accomplish the desired effects and those that may induce undesired effects. By now, effects-based planning and SoSa have provided many, if not most, of the needed tasks in the form of actions that produce particular effects. The lists of tasks are then assigned metrics known as Measures of Performance (MOPs) that measure how well the tasks are being accomplished during execution. Like MOEs, MOPs are specific, measurable, and quantifiable statements that help planners, operators, and assessors determine if the tasks are being accomplished. Put another way, MOEs convey “are we doing the right things” while MOPs convey “are we doing things right” (Joint Warfighting Center 2004, 16 and 17). Figure 10 completes the picture.

**SITUATION:** Two regional countries are contesting ownership of a set of islands. Both state that they have long-standing historical basis for their claims. Both are relatively equal in military capability, and Country X has placed limited military forces on one of the islands. Country Y is threatening a military response. A war between the two countries would destabilize the region, which the President considers a threat to US vital interests. He has decided to intervene and has established several strategic objectives that contribute to the desired end state. Opposite is one objective, two sample effects related to Country X, and associated MOEs. Figure 5 expands the example to include sample nodes, actions, and related measures of performance (MOPs).

**Desired End State:** Long-term peace and stability in the region.

**US Objective:** Countries X and Y resolve disputed islands issue peacefully.

**Effect 1:** Country X engages Country Y in diplomatic efforts to resolve crisis.

MOE: Level of inflammatory rhetoric.

MOE: Volume of diplomatic communiqués.

**Effect 2:** Country X withdraws military forces from the island.

MOE: Level of forces on the island.

Figure 9. Example Objectives, Effects, and MOEs

Source: Joint Warfighting Center Doctrine Pamphlet 7, *Operational Implications of Effects-based Operations (EBO)* (Suffolk, VA: US Joint Forces Command, 17 November 2004), 13.

Provided the effects-based planning was properly conducted, execution is simply a matter of accomplishing the identified tasks, measuring their execution via MOPs, and “continuously assess[ing] progress toward attaining the desired effects” (JWFC 2004, 16) via MOEs. EBO is a cyclical process wherein the lines between planning, execution, and assessment are justifiably blurred to allow for continuous feedback and improvement of the accomplishment of the mission objectives and end state.

**US Objective:** Countries X and Y resolve disputed islands issue peacefully.

**Effect 1: Country X engages Country Y in diplomatic efforts to resolve crisis.**

**Nodes A & B: Country X and Y foreign ministries.**

**Action:** US Department of State delivers demarches.

**MOP:** Demarche delivered by US Ambassador and content acknowledged by Foreign Ministers.

**Effect 2: Country X withdraws military forces from the island.**

**Node A: Country X foreign ministry.**

**Action:** US Department of State delivers demarche.

**MOP:** Demarche delivered by US Ambassador and content acknowledged by Foreign Minister.

**Node C: Country X forces on island.**

**Action:** Joint force overtly monitors withdrawal.

**MOP:** Low-level recon overflights conducted by US and observed by Country X.

**Nodes D & E: Country X and Y defense ministries**

**Action:** JFC maintains visible US military presence.

**MOP:** Forces positioned and activities conducted by JFC and observed by Countries X and Y.

Figure 10. Example Nodes, Actions (Tasks), and MOPs

Source: Joint Warfighting Center, *Doctrine Pamphlet 7, Operational Implications of Effects-based Operations (EBO)* (Suffolk, VA: US Joint Forces Command, 17 November 2004), 14.

There is considerable space within the context of effects-based execution for operators to adapt their execution in a changing environment in order to improve the accomplishment of the desired effect and minimize undesired ones. Essential to this is knowledge and understanding of the mission's objectives and the effects required to achieve those objectives, represented by commander's intent, explored in detail later.

Finally, the discussion of effects-based approach concepts concludes with effects-based assessment which builds on the objective-based combat assessment (CA). CA is “the determination of the overall effectiveness of force employment during military operations,” and is composed of three components: (1) battle damage assessment; (2)

munitions effectiveness assessment; and (3) reattack recommendation. EBO takes the traditional level of assessment, which is primarily target-based, a step further by “identify[ing] progress toward accomplishment of objectives . . . by using two primary criteria—MOPs and MOEs” (JWFC 2004, 16).

The final step in effects-based assessment is campaign assessment, whereby planners and assessors compare current conditions to desired end state for the overall campaign and make adjustments to cause reality to equal the envisioned end state (JWFC 2004, 16).

The ideas in this Effects-Based Concepts section suggest a simple, but essential, improvement on the current joint planning process through the insertion of effects considerations into the objective-based approach methodology. These improvements have been made courtesy of Michael Carpenter of the MITRE Corporation (figures 11 and 12).

Figure 12 depicts the effects-based methodology in the pyramidal orientation common to depictions of strategy-to-task or objective-based hierarchies like the one shown in figure 11. That orientation facilitates better understanding of the evolutionary relationship of effects-based approaches to objective-based by presenting them in the same way and highlighting their similarities instead of their differences.

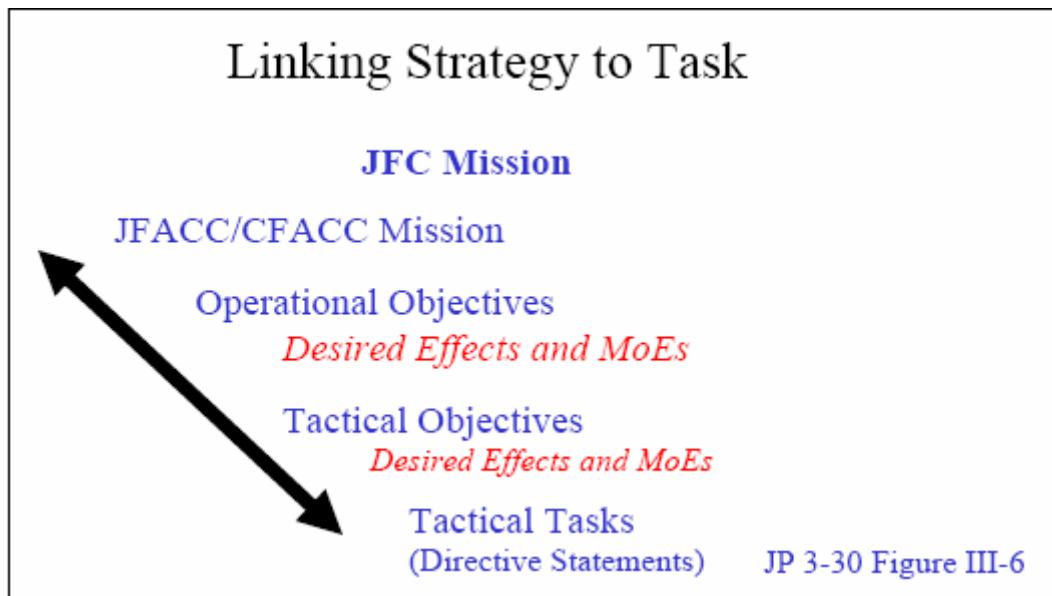


Figure 11. Effects Incorporated Into Objective-Based Planning Methodology  
 Source: Carpenter, *Evolving to Effects Based Operations* (Hampton, VA: the MITRE Corporation), 6.

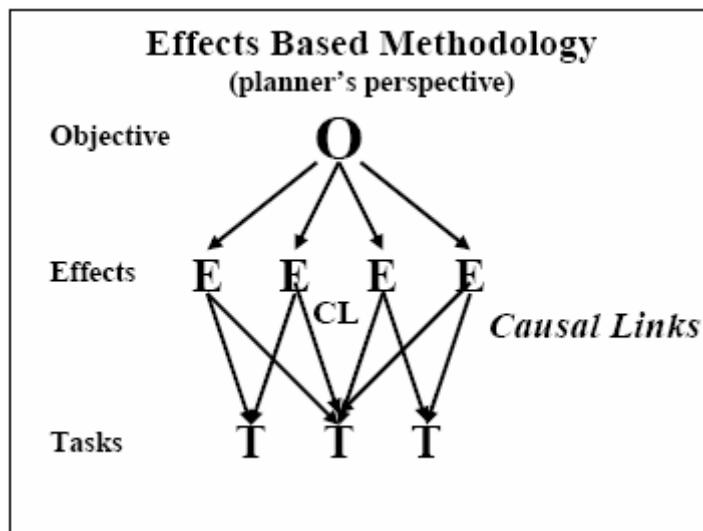


Figure 12. A New Look at the Effects-Based Methodology (Planners' Perspective)  
 Source: Carpenter, *Evolving to Effects Based Operations* (Hampton, VA: the MITRE Corporation), 7.

## Current Status of Effects-Based and CAS Joint Doctrine and Tactics, Techniques, and Procedures

Effects-based approaches have been widely discussed and written about at the strategic and operational levels over the past decade and even incorporated in formal processes to some degree, particularly at strategic and operational levels in the USAF. The joint force is only recently beginning to delve into the doctrinal application of effects-based approaches. The following sections describe the current state of effects-based and CAS joint doctrine and TTP.

### Joint Operations and Fire Support Doctrine

Joint CAS doctrine and TTP are embedded in joint operations publications, falling under joint fire support. Before describing current joint CAS TTP, joint doctrine is examined starting with Joint Publication 3-0, *Doctrine for Joint Operations*.

JP 3-0 categorizes CAS as a type of joint fires or joint fire support (JP 3-0 2001, IV-16). To fully understand the implications of these labels it is helpful to define all of the terms associated with them. “Fires are the effects of lethal or nonlethal weapons. Joint fires are fires produced during the employment of forces from two or more components in coordinated action toward a common objective. Joint fire support is joint fires that support air, land, maritime, amphibious, and special operations forces to move, maneuver, and control territory, populations, airspace, and key waters” (JP 3-0 2001, III-27). Given JP 3-0’s last publication date in 2001, it is likely the authors had the joint definition of effect presented in chapter 1 in mind, that is “a change to a condition, behavior, or degree of freedom,” and not the refined definition presented in this chapter: “the physical and/or behavioral state of a PMESII system that results from a military or

non-military set of actions (DIME).” Nevertheless the two definitions of effect are compatible with the latter simply a refinement.

Joint doctrine classifies CAS as a form of *lethal* fires as seen in the phrase, “Joint fires and joint fire support may include, but are not limited to, the lethal effects of close air support by fixed- and rotary-wing aircraft” (2001, IV-16 and JP 3-09 1998, I-2). When exploring effects-based approaches it is important to look at all types of effects, lethal and non-lethal. In keeping with that idea an important note is that CAS has historically had effects beyond lethal ones, especially in the past five years in Operations Enduring and Iraqi Freedom (Read 2005, 1-9).

### Joint CAS Doctrine

#### Introduction

A full understanding of joint CAS requires a thorough reading, comprehension, and application of JP 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support*. This section does not fully illuminate joint CAS but rather highlights CAS planning (and preparation), execution, and assessment processes as they relate to objective- and effects-based approaches.

JP 3-09.3 is an objective-based approach TTP document that builds on the definitions and processes in JP 3-0 and JP 3-09, *Doctrine for Joint Fire Support*. All joint doctrine will soon begin incorporation of an effects-based approach starting with JP 3-0 sometime in 2006 (Hubner 2004, 8), but for now there is virtually no mention of effects-based approaches or EBO in joint CAS doctrine and TTP. There are, however, a lot of ideas similar to EBO.

“CAS provides fires in offensive and defensive operations to destroy, disrupt, suppress, fix, harass, neutralize, or delay enemy forces” (JP 3-09.3 Chg 1 2005, I-2). This statement lays out a range of effects that supported ground commanders may expect from CAS. These effects are defined later but for now it is enough to recognize that even within an objective-based approach the authors of JP 3-09.3 recognized the need for discussing desired effects. This is likely due to the US Marine Corps (USMC) having lead authorship of JP 3-09.3. The USMC, along with the US Army, are one of the two principal recipients of joint CAS, and the lead authors of joint terms addressing effects on an enemy force.

### Targeting

Joint fire support, and by extension, CAS, are functional areas that naturally lead into targeting. The joint definition of a target is “an area, complex, installation, force, equipment, capability, function, or behavior identified for possible action to support the commander’s objectives, guidance, and intent.” JP 3-09.3 states that: “At the tactical level, targeting is the process of selecting and prioritizing individual targets and matching the appropriate response to them, taking account of operational requirements and capabilities.” Joint CAS has all the elements of objective-based methodology since it considers commander’s objectives, in this case tactical objectives, determines something that can be acted against in support of those objectives (a target), then prioritizes and matches a CAS resource to that target. What is missing in terms of EBO is identification of a desired effect and the causal links, or mechanisms, and actions that would achieve those effects. While those considerations are explicitly absent in CAS doctrine, a deeper

exploration of commander's intent brings current doctrine closer to an effects-based approach than is first evident.

### Commander's Intent

Essential to the primary research question is the idea of commander's intent. Prior to commander's intent in any operation is the unit's tactical mission, or mission statement. A tactical unit's *mission* is defined in joint doctrine as "the task, together with the purpose, that clearly indicates the action to be taken and the reason therefore" (JP 1-02 2005, mission). The word task in this definition is not the one provided in chapter 1 but is more akin to the joint term *objective* which is "the clearly defined, decisive, and attainable goals towards which every military operation should be directed." Thus, a mission states a goal and a purpose for achieving that goal. Accomplishment of the unit mission is a yes or no assessment; was the stated goal achieved or not? While there are numerous ways to *effectively* accomplish a goal, commander's intent refines the visualization of that goal and speaks to the *efficiency* and completeness of mission accomplishment.

Joint doctrine defines commander's intent as "a concise expression of the purpose of the operation and the desired end state that serves as the initial impetus for the planning process" (JP 1-02 2005, commander's intent). Purpose gives reason for achieving the mission task or goal and nests with higher and subordinate unit mission statements. Pivotal to the commander's intent definition is the term *end state*.

The end state is "the set of required conditions that defines achievement of the commander's objectives" (JP 1-02 2005, end state). As set forth above, objective is synonymous with task in a unit's mission statement, so the end state defines achievement

of the mission task or objective in terms of *required conditions*. When comparing the two similar definitions of effect presented earlier in this thesis a connection between effects, conditions, and desired end state begins to be clear.

US Army doctrine includes in a commander's intent expanded purpose, or broader operational context of the unit mission, key tasks, and end state (FM 5-0 2005, 3-6). While the end state and purpose are defined the same as in joint doctrine, Army doctrine expands on commander's intent to include key tasks which are "those tasks that the force as a whole must perform or *conditions the force must meet* to achieve the end state and stated purpose of the operation" [emphasis mine] (FM 6-0 2003, 2-18). If throughout this discussion the term *condition* is replaced with *effect*, a correlation of objective-based operations to EBO begins to take shape.

The art here is for CAS operators to tie commander's intent, specifically the key tasks or conditions and desired end state, to targets in preplanned and immediate situations. This is a responsibility not only for surface CAS planners and operators like air liaison elements, but also for CAS crews. Both JP 3-09.3 and the multi-service manual for the joint application of firepower (J-FIRE) list mission, objectives, and commander's intent as important aircrew mission planning considerations (JP 3-09.3 Chg 1 2005, C-3 and J-FIRE 2004, 34). While air liaison elements, such as a USAF or USMC tactical air control party, receive the mission and commander's intent for the overall operation and for CAS during formal mission planning, the delivery of this critical information to air support units is often convoluted and inconsistent.

Doctrinally, the services have liaison organizations and positions within each others' command and control elements to conduct coordination, synchronization, and

integration of CAS assets and missions. Examples include the US Navy's supporting arms coordination center or the US Army's ground liaison officer (JP 3-09.3 Chg 1 2005, II-11 and II-6). These and other formal liaison elements should be sufficient to create an effective flow of information both within and between services but three problems often present themselves: (1) lack of liaison aggressiveness or poor job knowledge; (2) no doctrinal tactical-level CAS liaison elements between the US Army and USMC / Navy or the USAF and USMC; and (3) poor communications connectivity (Wiggins 2005).

With the first problem, liaison element effectiveness is often personality-dependent. Aggressive, knowledgeable liaisons personnel can obtain required data such as mission and intent and get it to the operators in a timely manner. Likewise, operators who aggressively seek out this information through their liaison officers can push the process in reverse as well. The specific information sought out is the supported ground unit's mission statement from their operations order and the commander's intent for fires and CAS from the fires paragraph or fire support annex (JP 3-0.3 Chg 1 2005, III-10). These push and pull approaches work well as long as a formal liaison position is established, such as a US Army ground liaison officer at a USAF wing operations center, but can fail when no formal liaison structure is in place.

When no formal tactical-level liaison structure exists, for example when USMC aircraft provide CAS to the Army, CAS crews may arrive in the area of operations (AO) with little or no information about the mission or intent of the commander they are about to support. In these situations, CAS crews almost always receive the supported ground commander's intent via radio communications directly from the tactical air control party or JTAC providing terminal control in the AO (Buryanek 2005).

JP 3-09.3 defines this communication between the JTAC and CAS aircrew as a Situation Update and specifies (supported) unit mission as one of the update items, but does not mention commander's intent (JP 3-09.3 Chg 1 2005, V-21). J-FIRE, on the other hand, in its Format 13: Situation Update, lists neither mission nor intent, only the vague "Friendly Situation" (J-FIRE 2004, 46). So it is left to the training, judgment, and initiative of CAS ground parties and aircrew to transmit or request supported ground unit mission and intent. In many instances neither mission nor intent are passed or requested, and the CAS players move directly into the procedural exchange of asset information and targeting data.

Assuming either the ground controller plans to send commander's intent or the aircrew requests it, the format will often need to be concise due to CAS aircraft having fuel and time constraints, sounding more like a targeting assignment than an intent statement. For example, targeting data: "Hog 1, this is AC3, the ground commander's intent for CAS is to destroy eight tanks in Brown Pass," (Buryanek 2005) versus intent: "Hog 1, this is AC3, the ground commander's intent for CAS is to disrupt movement of the 3rd Guards Tank Regiment to allow 2nd BN to advance to phase line Smith."

Finally, connectivity between ground units in the field and CAS aircrews at air bases, forward operating locations, or on an aircraft carrier is often poor due to communication systems differences and incompatibilities. Solutions tend to be personality-dependent, with aggressive liaison officers establishing contact via secure voice or secure internet protocol router network e-mail then obtaining mission, intent, and other critical supported ground force information (Wiggins 2005).

## Planning

The majority of joint CAS doctrine (JP 3-09.3) centers on planning and preparation, then execution, with assessment a largely incomplete third place.

Joint CAS planning uses a decision-making construct modified from the decision-making processes used for mission planning by the US Army and USMC. This planning construct similarity allows CAS planning to be conducted in parallel with other portions of the ground commander's mission planning. The joint CAS planning phase is depicted in figure 13.

Figure 14 is a portrayal of the tasks and considerations CAS planners need to complete during various steps in the ground commander's decision-making process. Of note, is the instruction to "Quantify Effects" beneath the task "Determine Locations of EFSTs Formations" in the COA Development step. This is important as this paper begins to discuss Essential Fire Support Tasks (EFSTs).

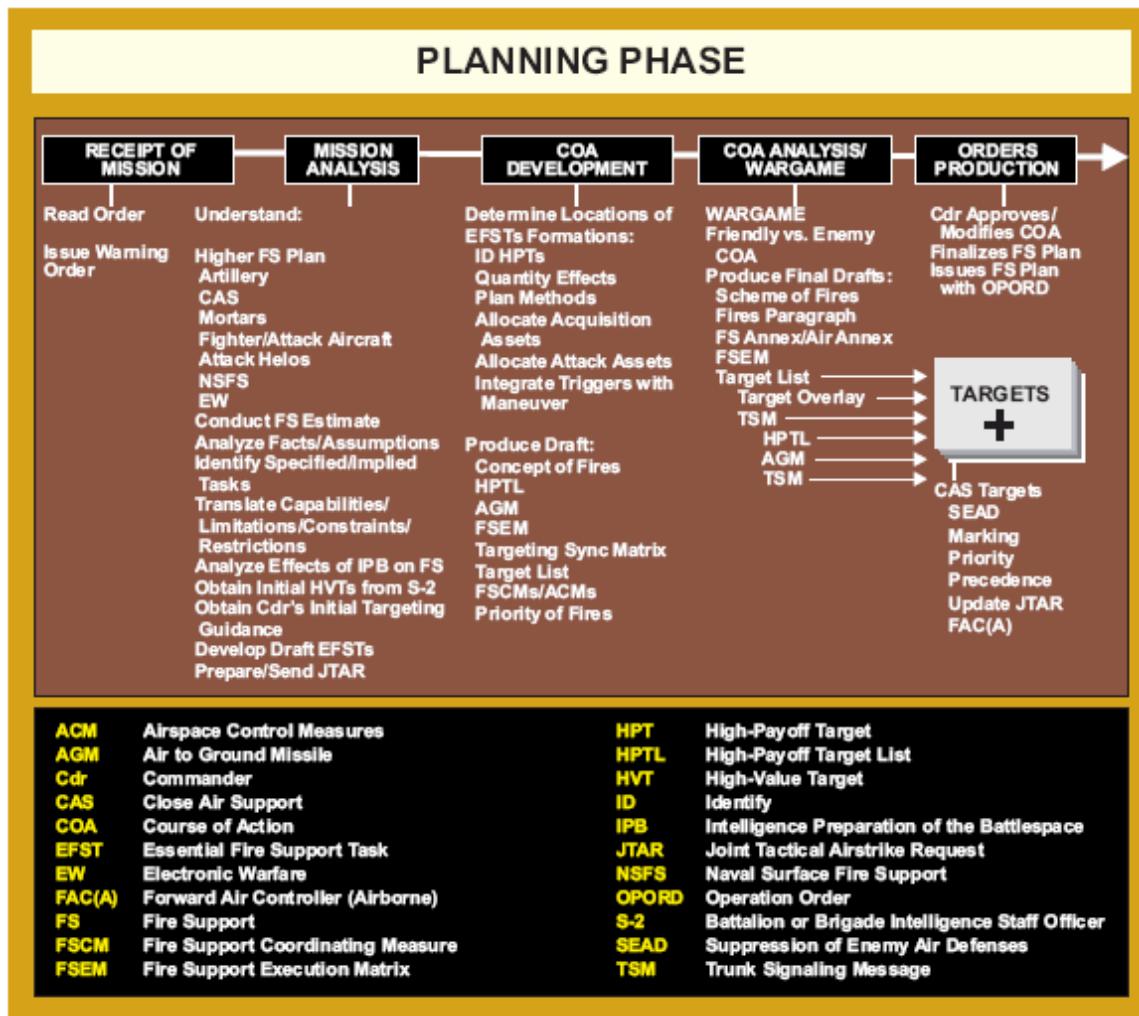


Figure 13. The Joint CAS Planning Phase

Source: JP 3-09.3 Chg 1, *JTTP for CAS* (Washington, DC: the Pentagon, 2 September 2005), III-4.

A ground commander's concept for fires is ultimately represented by EFSTs (JP 3-0.3 Chg 1 2005, III-5). During mission planning fire support and CAS planners continuously refine the fires paragraph of the operations order ultimately arriving at a list of CAS EFSTs. "EFSTs are composed of four distinct components: task, purpose, method, and effects (TPME)" (JP 3-09.3 Chg 1 2005, III-9). JP 3-09.3 describes the TPME construct for EFSTs as:

1. Task: Describes the targeting objectives fires must achieve against a specific enemy formation's function or capability. Example: Disrupt movement of 3rd Guards Tank Regiment.

2. Purpose: Describes the maneuver or operational purpose for the task. Example: To allow 2nd BN to advance to phase line Smith.

3. Method: Describe how the task and purpose will be achieved. Example: CAS engages armored targets vicinity of Brown Pass not later than 1400L.

4. Effects: Attempts to quantify the successful accomplishment of the task. Example: CAS destroys 8–10 vehicles vicinity Brown Pass; 2-69 Armor secures Brown Pass (JP 3-09.3 Chg 1 2005, III-9 and -10).

Even though joint CAS doctrine is not explicitly effects-based, it does include some consideration of effects. Still, fire support and CAS EFSTs, and their TPME format, fall short of true EBO because their terminology definitions and usage are founded in the objective-based approach prevailing in US military doctrine.

To illustrate this point it is helpful to revisit some of the effects-based concepts presented earlier. A task is “an action or activity (derived from an analysis of the mission and concept of operations) assigned to an individual or organization to provide a capability,” while effect is defined as “the physical and/or behavioral state of a system that results from a military or nonmilitary set of actions.” An action is “an activity directed at a specific node,” and a node is “a person, place, or physical thing that is a fundamental component of a system.” (see figure 5)

Applying these terms to TPME and the examples presented above, the terminology dissimilarities between objective- and effects-based approaches become

apparent. When the current TPME format terms and definitions are removed, leaving only the examples, which are then recast in an effects-based light (see example), effects-based ideas are present, even if accidentally, in current CAS planning doctrine:

1. Disrupt movement of 3rd Guards Tank Regiment. (Effect)
2. Allow 2nd BN to advance to phase line Smith. (Objective)
3. CAS engages armored targets vicinity of Brown Pass not later than 1400L. (Resource-Action [Task]-Node)
4. CAS destroys 8–10 vehicles vicinity Brown Pass; 2-69 Armor secures Brown Pass NLT 1400L. (Measure of Performance and Measure of Effectiveness)

Or, reorganized in the Carpenter effects-based methodology format (figure 13) fused with the EBO E-N-A-R concept:

1. Objective: Allow 2nd BN to advance to phase line Smith.
2. Effect: Disrupt movement of 3rd Guards Tank Regiment.
  - a. MOE: 2-69 Armor secures Brown Pass NLT 1400L.
3. Node: Tanks of the 3<sup>rd</sup> Guards Tank Regiment.
4. Action (Task): Engagement.
  - a. MOP: 8–10 vehicles destroyed vicinity Brown Pass
5. Causal Linkage (Mechanism): Slows enemy tank movement; diverts enemy attention and effort.
6. Resource: CAS assets.

The JP 3-09.3 examples above were not originally conceptualized in an effects-based environment so some of the wording is not completely consistent with an effects-based approach. Nonetheless, the example illustrates the parallels in thinking between the

current joint CAS and effects-based approaches. One should not take from this illustration the idea that an effects-based approach is only a semantic exercise, renaming terms and concepts already in use in into effects-based ones. Rather, the lesson is that EBO is a distinctly different way of framing and approaching planning, execution, and assessment, but not a revolutionary change so radical that all current objective-based doctrine and TTP is rendered obsolete.

As the joint CAS planning phase moves through preparation and fire support rehearsal, JP 3-09.3 advises CAS planners that “requests for CAS should clearly describe the desired effects to meet the commander’s intent.” CAS providers at the operational level are then advised to “tailor aircraft and weapons loads to achieve the desired effects” (Chg 1 2005, IV-2). Thus, the conditions necessary to achieve the supported ground commander’s desired end state must always figure prominently in the CAS planner’s efforts.

### Execution

“CAS execution [depicted in figure 14], begins with a target nomination from the supported commander and involves two processes that are continuous and overlapping in nature: [CAS planner and controller]/Operations Center coordination and CAS target engagement” (JP 3-09.3 Chg 1 2005, V-1).

JP 3-09.3 also adds fix, harass, and suppress as additional effects of CAS (Chg 1 2005, I-2) defined as:

1. Fix: A tactical mission task where a commander prevents the enemy from moving any part of his force from a specific location for a specific period of time (the US Marine Corps uses the term block) (FM 1-02 and MCRP 5-12A 2004).

2. Harassment: An incident in which the primary objective is to disrupt the activities of a unit, installation, or ship, rather than to inflict serious casualties or damage (JP 1-02 2005).

3. Suppression: Temporary or transient degradation by an opposing force of the performance of a weapons system below the level needed to fulfill its mission objectives (JP 1-02 2005).

The above presentation of definitions of the purposes for attacking targets reveals again that, although the terminology does not always match, current objective-based joint CAS incorporates the idea of effects, if not a complete effects-based paradigm.

Nomination of targets in joint CAS execution is a misnomer in that joint targeting doctrine describes target nomination as: “Once potential targets are identified and validated, they are nominated through the proper channels for approval, generally involving their deliberation in a coordinating body such as the joint targeting coordination board” (JP 3-60 2002, II-5). While this process certainly holds true at the joint operational level for targeting, any supported tactical ground commander is almost always the validating, nominating, and approving authority for targets within his AO. In the strictest sense of the process, the supported ground commander is proceeding through the steps of validation, nomination, and approval, either in conjunction with his staff during deliberate mission planning, or real-time during immediate execution.

During CAS missions operators receive targets through the identification and validation process in joint CAS doctrine and directly from the supported ground commander consistent with mission-type orders and the commander’s intent. This appears simpler than the extensive coordination during joint operational targeting but the

catch during CAS execution is identification, validation, and successful engagement of targets that will contribute to the achievement of conditions fulfilling the supported ground commander's desired end state and not just attacking targets to make use of available air assets.

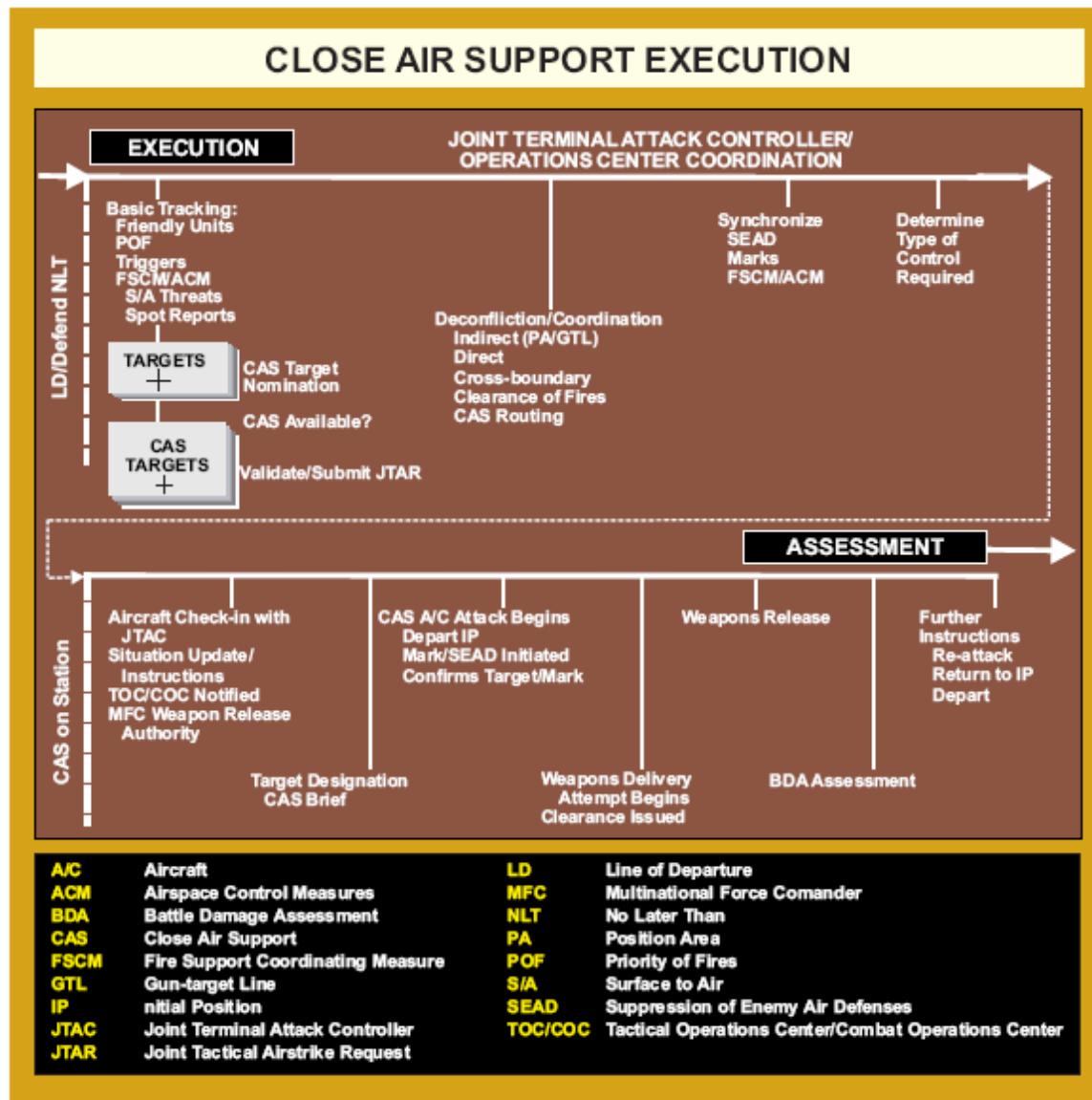


Figure 14. Joint CAS Execution Phase  
Source: JP 3-09.3 Chg 1, *JTTP for CAS* (Washington, DC: the Pentagon, 2 September 2005), V-2.

## Assessment

The assessment process begins when planned or immediate targets have been engaged during CAS execution. This is the least developed area in current joint CAS doctrine. Three entire chapters in JP 3-09.3 are devoted to CAS planning, preparation, and execution while only two and a half pages are devoted to assessment of the effectiveness of CAS attacks or actions (Chg 1 2005, V-26 to -28).

The method for joint CAS assessment is called battle damage assessment (BDA) (JP 3-09.3 Chg 1 2005, V-26) which is only one part of the current joint combat assessment process depicted in figure 15.

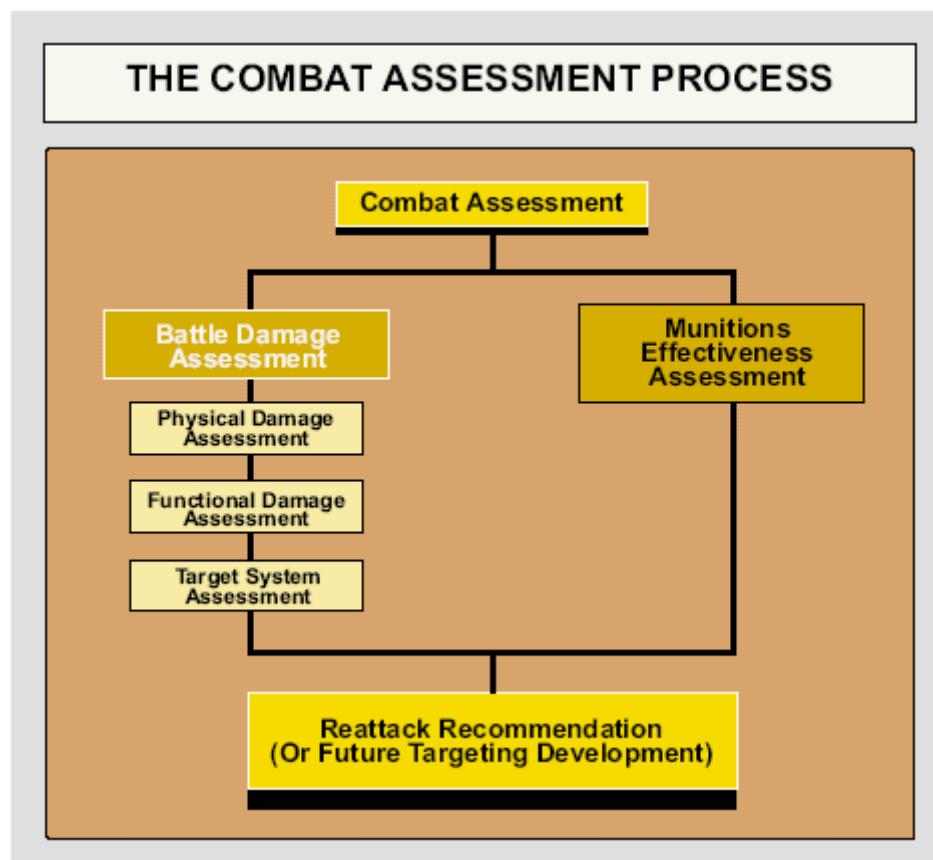


Figure 15. The Combat Assessment Process

Source: JP 3-60, *Joint Doctrine for Targeting* (Washington, DC: the Pentagon, 17 January 2002), II-2.

Munitions effectiveness assessment deals with the interaction of weapons, delivery platform, and target “to compare the actual effectiveness of the means employed to their anticipated effectiveness” (JP 3-60 2002, II -10). The results are intended to improve future doctrine, TTP, and capabilities. Little, if any, munitions effectiveness assessment occurs in real-time on a CAS battlefield and there is often insufficient data collected after a CAS attack to accurately complete munitions effectiveness assessment later. For this paper MEA is inconsequential while BDA is very applicable.

The extent of JP 3-09.3’s specific guidance on BDA is: who reports it, to whom, and how, with what is being reported being “observed damage” (Chg 1 2005, V-27). JP 3-60 breaks down the three components of BDA in more detail:

1. Physical Damage Assessment: The estimate of the quantitative extent of physical damage (through munitions blast, fragmentation, and fire damage effects) to a target resulting from the application of military force. This assessment is based upon observed or interpreted damage.
2. Functional Damage Assessment: The estimate of the effect of military force to degrade or destroy the functional or operational capability of the target to perform its intended mission and on the level of success in achieving operational objectives established against the target. This assessment is based upon all-source information, and includes an estimation of the time required for recuperation or replacement of the target function.
3. Target System Assessment: Projects results on the overall functioning of the target system and the consequent changes in the adversary’s behavior.

As can be seen from the definitions above, BDA consists of a progressively more detailed group of judgments that must be made concerning a CAS target. These assessments are made by CAS operators (pilots and Joint Terminal Attack Controllers [JTACs]) and fire supporters in real-time during immediate CAS execution in the same way that ground forces must determine the effectiveness of other fires and maneuver while the battle is occurring.

The last component of combat assessment is the re-attack recommendation. Given the limitations of BDA already presented, CAS operators, in conjunction with the supported ground force, need to make a determination as to whether or not that target needs to be engaged again and by what capability -- CAS, other fire support, and/or direct fire. This is a critical determination if the target is essential to accomplishment of the commander's intent, which it should be if forces are being employed in an efficient and economical manner. The challenges of BDA and re-attack determination are made clearer through the following example.

A flight of two A-10s are tasked to engage a column of eight enemy tanks from the 3rd Guards Tank Regiment in Brown Pass after dark. The A-10 flight lead requests the use of the GAU-8 30mm cannon and is authorized its use by the supported ground commander through his JTAC. Following two strafe attacks the A-10 flight lead and his wingman observe what they believe to be "good hits" on two tanks while covering each other's off-target maneuvers. The JTAC, who is two kilometers away, does not observe the actual hits but notes through night vision goggles that two tanks have stopped. One of the A-10s is carrying a Litening II<sup>©</sup> targeting pod and using the infra-red setting slewed to the target area tells the JTAC that he believes one of the stopped tanks is burning. Who

determines the BDA in this scenario and to what level, physical through target system, can that BDA be accurately judged? Finally, should the flight re-attack the two stopped tanks or continue the attack on the remaining six moving targets? Such is the set of challenges facing modern CAS operators in the area of assessment.

### Summary

This chapter reviewed the relevant literature regarding an effects-based approach as it relates to CAS planning, execution, and assessment. The research presented within this chapter illustrated recent EBO history, fully defined effects-based concepts while describing the objective-based approach currently used in joint CAS processes, and showed the status of current joint effects-based and CAS doctrine and TTP.

The joint world has been attempting to incorporate effects-based approaches to military operations for some time now but has only recently began to institutionalize EBO into joint publications, doctrine, and TTP. This relatively recent acceptance of EBO has led to confusion with terms, concepts, and methodologies that will not be fully clarified until the effects-based approach is incorporated into joint doctrine.

The current approach methodology used for joint planning, execution, and assessment is the strategy-to-task or objective-based approach. Most joint and service-specific publications, especially in the joint function of CAS, reflect the objective-based methodology.

Despite the prevalence of the objective-based approach there are elements, however unintentional they may be, of effects-based thinking and methodology in joint CAS doctrine and TTP.

While joint CAS doctrine has a solid body of planning and execution information, it is weak in the area of combat assessment, specifically the component most applicable to CAS -- BDA. The chapter also concluded with some of the challenges inherent in real-time assessment of joint CAS execution.

Next, chapter 3 will describe the methodology used in analysis of the primary research question.

## CHAPTER 3

### ANALYSIS METHODOLOGY

This chapter presents the methodology used for analysis and determination of an answer to the thesis primary research question. Chapter 3 is divided into two main parts: Background, which establishes the basis for the analysis methodology chosen, and Explanation, which portrays the details of the chosen method.

#### Background

The minimal amount of effects-based concepts in joint CAS doctrine limits a doctrinal comparison of the current objective-based versus effects-based approaches. Regardless, a comparison of doctrine would likely yield little of substantive value since doctrine by its nature is a set of held values and beliefs not all of which are necessarily supportable by empirical data.

A better analysis approach would be to compare, in as quantifiable a manner as possible, an historical objective-based joint CAS operation with an effects-based one. Unfortunately, despite the recent interest and emergence of EBO as a dominant theme in joint thinking, especially in the fire support branches, there are no clearly documented case studies of effects-based CAS operations.

This situation leads into the same area that US Army Major John Harris found himself in 2003 when writing his thesis “Effects-Based Operations: Tactical Utility.” In that study Harris was faced with a US Army that was just beginning to incorporate EBO into tactical level doctrine (Harris 2004, 32) and had not yet collected any case studies or lessons learned of effects-based operations from Operations Enduring or Iraqi Freedom.

Given these problems Harris elected to conduct an analysis using a qualitative comparison of relevant US Army tactical-level evaluation criteria of his own devising (Harris 2004, 41). His criteria and resulting comparison matrix are provided in table 3.

Table 3. Harris Thesis Qualitative Comparison Matrix

Evaluation Criteria	Objectives-Based Operations	Effects-Based Operations
Clear visualization		
Efficient use of resources		
Effective use of resources		
Synchronization		
Flexible and adaptive execution		
Assesses the results of actions on entire battle space		

Source: Harris, *Effects-Based Operations: Tactical Utility* (Fort Leavenworth, KS: US Army Command and General Staff College, 18 June 2004), 42.

This thesis uses a similar qualitative analysis approach. The next step is determining qualitative analysis criteria, but not until first addressing one part of the research question.

Terms in the primary research question have been defined except the phrase “improve achievement.” This study does not attempt to answer the question of whether or not an effects-based approach can improve achievement of the supported ground commander’s *mission*. Since a ground unit’s mission is comprised of a task and purpose, if that task is not accomplished, then the mission is by definition a failure, and therefore *ineffective*. Mission accomplishment is a pass or fail determination; it either is

accomplished or it is not. Numerous approaches, objective-, effects-based and others, can, have, and will *effectively* accomplish missions.

The primary research question does not drive toward effectiveness as much as it addresses *efficiency* and *economy*. This is where commander's intent comes into play. Commander's intent attempts to clarify the mission in terms of a commander's visualization of a desired end state and the key conditions he sees as necessary to achieving that end state. A mission *may* be successful and yet not achieve the exact end state set forth by the commander, just as it might be successful without all the key conditions being met. But realization of the desired end state through achievement of the key conditions is *most likely* to complete the mission through efficient and economical operations that preserve forces, capabilities, and combat power for use elsewhere in the battlespace.

Thus, improved achievement of commander's intent is measured through those operations that best achieve the key conditions and best realize the desired end state. This line of thinking is at the center of the thesis primary question and drives the qualitative criteria presented next.

### Explanation

Chapter 4 uses a qualitative comparison of objective-based and effects-based approaches to the conduct of joint CAS. The comparison uses subjective evaluation criteria relevant to improving achievement of commander's intent through the application of CAS.

## Evaluation Criteria

The evaluation criteria are broken down into the over-arching categories of planning (to include preparation), execution, and assessment. Each criterion is presented as a yes or no question to facilitate answering the primary research question.

### Planning

1. Accurately determines conditions (effects) required to achieve the desired end state. -- This criterion determines whether or not the two approaches considered, objective- or effects-based, visualize the conditions needed to realize the envisioned CAS mission end state during planning.
2. Contributes to friendly understanding of enemy systems and interdependencies. -- Does the approach assist in better understanding the enemy force as an interconnected system within which any action can have intended and unintended consequences? A better appreciation of the enemy system, including its links and nodes, allows more effective and efficient utilization of CAS in support of the surface commander's mission and intent.
3. Do CAS players receive and internalize commander's intent? --Within the context of this criterion, "players" includes the principal participants in CAS activities to include the surface liaison officers, JTACs, CAS strike pilots and forward air controllers (airborne) (FAC[A]s). This question measures whether or not CAS players, during the course of planning, receive the supported commander's intent and takes a subjective measure of how well the approach allows them to internalize that intent to increase effectiveness and/or efficiency in execution.

## Execution

1. Is the approach timely? -- While this criterion would normally be very quantifiable, for example, “CAS tasks completed within ten minutes,” that explicitness fails to address the variables inherent in every CAS situation. Without applying a specific time window to the criterion, with all factors being equal, quicker planning and execution is preferable to slower.

2. Does it minimize exposure of CAS air assets to enemy threat systems? -- CAS missions can be effective and still result in losses of personnel and equipment. This criterion measures efficiency in terms of limiting exposure of CAS air assets to enemy air defenses to preserve CAS combat power for future operations.

3. Are the minimum required actions applied to achieve the desired effects/conditions? -- This criterion speaks to economy by evaluating the level of resources applied to achieve a desired effect or condition. If the minimum resource is used in realizing key conditions then excess combat power is available for use in follow-on operations.

4. Is it flexible? -- This is the ability to respond to inputs from a changing environment and still meet commander’s intent. Complementary to this criterion is the CAS operator’s knowledge and understanding of that intent.

5. Does it provide desired effects or establish key conditions? -- The question here is whether or not the approach being evaluated allows CAS players to appreciate and contribute to effects and conditions that lead to the envisioned end state instead of simply engaging targets identified in a target-based methodology.

## Assessment

1. Does it provide timely, accurate evaluation of execution results? -- This question also looks at economy of force, ensuring that results are determined so that CAS assets may be used for other priority tasks or preserved for future operations.

2. Does it allow for a timely, correct re-attack decision? -- Related to the first assessment question, this criterion determines if the approach evaluated facilitates completion of the combat assessment chain by identifying the need for a re-attack to accomplish the desired effect or condition.

3. Does it facilitate improvement of TTP and capability through timely, accurate determination of overall CAS mission effectiveness and efficiency? – This criterion assumes that assessment of overall mission effectiveness and efficiency will contribute to improvement of future execution, doctrine, TTP, and overall capability through the derivation of appropriate lessons learned.

## Comparison Methodology

The comparison is conducted through a written discussion and analysis using the evaluation criteria followed by a tabular summary of results (Table 4.). The results are represented in terms of comparative degree where + indicates “better than” the other approach, — indicates “worse than” the other approach, and +/— indicates “the same as” the other approach.

Table 4. Blank Objective- Versus Effects-Based CAS Comparison Matrix

Evaluation Criteria	Objective-based Approach	Effects-based Approach
<b>Planning</b>		
1. Accurately determines conditions (effects) required to achieve the desired end state		
2. Does it contribute to friendly understanding of the enemy system?		
3. Do CAS players receive and internalize commander's intent?		
<b>Execution</b>		
1. Is it timely?		
2. Does it minimize exposure of CAS air assets to enemy threat systems?		
3. Are the minimum required actions applied to achieve the desired effects or conditions?		
4. Is it flexible?		
5. Does it provide desired effects or establish key conditions?		
<b>Assessment</b>		
1. Does it provide timely, accurate evaluation of execution results?		
2. Does it allow for a timely, correct re-attack decision?		
3. Does it facilitate improvement of TTP and capability through timely, accurate determination of overall CAS mission effectiveness and efficiency?		

## CHAPTER 4

## ANALYSIS

### Overview

This chapter analyzes the thesis primary research question: can an effects-based approach to the conduct of joint CAS improve achievement of the supported ground commander's intent? This is accomplished through the qualitative comparison methodology described in the previous chapter. Each approach to the conduct of joint CAS is compared and evaluated in turn, with a summary of results presented in Table 5.

### Qualitative Comparison

#### Planning

Planning Criterion 1. Accurately determines conditions (effects) required to achieve the desired end.

#### Planning Criterion 1 -- Objective-based

The objective-based approach includes visualization of end state as part of its overall structure but does not effectively tie required conditions or effects to that desired end state. Overall mission intent for a ground commander is expressed in terms of expanded purpose, tasks or conditions (which can be synonymous with effects in this context), and end state. If a ground commander expresses the middle part of his intent statement in terms of tasks, then the visualization of effects required to achieve the end state begins to break down. If the commander expresses that section in terms of conditions (effects), then that visualization chain is more complete.

Using the chapter 2 example to illustrate these points, the task from the CAS EFST in the TPME format is “disrupt movement of the 3rd Guards Tank Regiment” with the effect being “destroy 8–10 vehicles vicinity Brown Pass.” The objective-based approach focuses on the end result of the TPME EFST, the effect of a task, instead of tasks to create effects, reducing the entire process to a targeting exercise. While both the task and effect of the objective-based EFST may lead to the commander’s desired end state, only the task in the JP 3-09.3 example EFST provides visualization of the conditions or effects necessary to achieve that end state without predetermining subordinate or supporting force course of action or tactics. But because method and final result (effect in the TPME) format are spelled out, initiative and imagination on how to accomplish the task are stifled.

Commander’s intent for fires or CAS typically involves little visualization or description relative to conditions or effects necessary to achieve a desired end state. Instead, fire supporters create EFSTs in the TPME format. TPME is a useful structure for organizing fire support tasks in support of objectives but falls short of effectively visualizing conditions required to meet the commander’s desired end state.

Overall, the objective-based approach does not clearly or accurately determine conditions or effects required to achieve the desired end state.

#### Planning Criterion 1 -- Effects-based

An effects-based approach is not alien to the current objective-based one but is a different way of conceptualizing operational and tactical design. Changing the tasks in the overall commander’s intent to conditions or effects and changing EFSTs from TPME

format to the format presented next would create an effective visualization of conditions and effects required to achieve the end state.

1. Objective: Allow 2nd BN to advance to phase line Smith.
2. Effect: Disrupt movement of 3rd Guards Tank Regiment.

MOE: 2-69 Armor secures Brown Pass NLT 1400L.

3. Node: Tanks of the 3<sup>rd</sup> Guards Tank Regiment.
4. Action (Task): Engagement.

MOP: 8–10 vehicles destroyed vicinity Brown Pass

5. Causal Linkage (Mechanism): Slows enemy tank movement; diverts enemy attention and effort.
6. Resource: CAS assets.

The conclusion is that an effects-based approach more accurately determines conditions or effects required to achieve the desired end state than does objective-based methodology.

Planning Criterion 2. Contributes to friendly understanding of enemy systems and interdependencies.

#### Planning Criterion 2 -- Objective-based

This is one of the weaknesses of the objective-based and target-based approaches and is one reason why airpower theorists began to move toward effects-based approaches. Objective- and target-based approaches create objectives and identify targets for a mission and then develop tasks to forces such as maneuver and fires, or mix the process up even more by creating objectives, delineating tasks, and then identifying

targets. The association between a tactical objective and effects required to achieve that objective are explicitly absent from objective- and target-based approaches.

This disconnect is not always evident when tactical and operational planners intuitively understand the connections between objective, task, and target, conduct analysis to ensure that the effects of tasks will achieve the objective and then identify targets for those effects and tasks. Unfortunately, that leap is often too great for most planners who fall back on “common sense” when developing tasks and targets to achieve objectives. Without sufficient analysis of enemy systems and interdependencies, objective-based planners are making their best guess at which tasks and targets will achieve their objectives and often fail to examine possible unintended consequences that may limit accomplishment of the objective, intent, or even the entire mission.

For these reasons an objective-based approach does not sufficiently contribute to friendly understanding of enemy systems and interdependencies.

#### Planning Criterion 2 -- Effects-based

An effects-based approach facilitates a focus on enemy systems and interdependencies by pushing planners to analyze for nodes, links, causes, mechanisms, and effects through ONA and SoSa. One of the key weaknesses of EBO and effects-based approaches may be the military planner’s inability to accurately deconstruct enemy systems, but the effects-based focus does have the potential to positively contribute to friendly understanding of enemy systems and interdependencies through systematic orientation and analysis.

Planning Criterion 3. Do CAS players receive and internalize commander’s intent?

### Planning Criterion 3 -- Objective- and Effects-based

Neither approach adequately supports realization of this criterion. The current objective-based approach contains checklist steps for CAS planning in both JP 3-09.3 and J-FIRE that include determination of the supported ground commander's mission and intent. However, neither of these checklists distinguishes between the commander's overall mission intent and his intent for fires or CAS, and only JP 3-09.3 adequately explains these distinctions in its text. Even if CAS aircrews work to determine mission and intent before takeoff and the air liaisons in the field endeavor to provide them, there is no guarantee that current connectivity between CAS air support and fielded units is sufficient to successfully communicate the required data. This also assumes that CAS aircrews know the unit they will be supporting prior to takeoff, which is often not the case. Even in the case of a preplanned mission, changing requirements on the ground regularly force CAS command and control elements to flex air assets to different AOs to properly support the ground commander's execution. Finally, if all of the aforementioned occurs, CAS players still have the opportunity to pass or receive mission and intent once airborne, but no current doctrinal checklist or format directs that to occur except the vague "Friendly Situation" step out of J-FIRE's Situation Update. Such an exchange is left to the training, judgment, and experience of the players involved.

An effects-based approach focuses on effects required to achieve objectives. CAS doctrine is improved to increase emphasis on providing all CAS players with commander's intent and providing a better language for conveying desired effects than the objective--or target-based devolution of "commander's intent for CAS is to destroy 8-10 vehicles."

## Execution

Execution Criterion 1. Is the approach timely?

### Execution Criterion 1 -- Objective and Effects-Based

CAS is an inherently arduous function. This is due to the ideas central to the definition of CAS: *close proximity* to friendly surface forces and *detailed integration* required with the fire and maneuver of those forces. The close proximity of CAS effects to friendly ground forces creates the potential for fratricide. Without deconfliction, synchronization, and integration of CAS actions with those of friendly surface forces, undesirable consequences can occur as the result of both lethal and nonlethal CAS actions. This drives a very procedure-oriented, communications-intensive, and time-consuming process.

The timeliness of CAS is a function of the communications and detailed integration required by the nature of the mission. Both approaches to CAS execution are equally timely, or equally untimely, depending on the specific situational factors of each individual CAS mission.

Execution Criterion 2. Does it minimize exposure of CAS air assets to enemy threat systems?

### Execution Criterion 2 -- Objective-based

While neither approach reduces the inherent risk presented by enemy air defenses to CAS air assets, the objective-based approach has the greatest potential to unnecessarily expose those assets to enemy air defenses. This is due to that approach often reflecting the achievement of objectives through the accomplishment of tasks that attack the

enemy's surface combat potential directly. In the chapter 2 example CAS is tasked to "disrupt movement of 3rd Guards Tank Regiment" (which has been shown to really be a desired *effect*) for the purpose of "allow[ing] 2nd BN to advance to phase line Smith," through a method of "engage[ing] armored targets vicinity of Brown Pass not later than 1400L," with the effect of "CAS destroy[ing] 8–10 vehicles vicinity Brown Pass." While the initial task listed in this objective-based CAS EFST is actually a desired *effect* on the enemy, the *method* and *effect* provided in the EFST drive air liaison officers (ALOs), JTACs, and CAS strikers to an engagement of fielded enemy forces.

CAS is historically one of the more dangerous air missions due to the large numbers of air defenses, such as small arms, automatic weapons, anti-aircraft artillery of all calibers, and surface-to-air missiles, present on the battlefield with, or in close proximity to, fielded military forces (Cooling et al 1990, 1 and 3). Fielded forces are the traditional focus for target- and objective-based approaches to CAS. Targeting fielded military forces with CAS may put those assets at greater risk than if they were used in other ways in the AO. Some examples of untraditional uses for CAS air are presented in the analysis of the next criterion.

#### Execution Criterion 2 -- Effects-based

Using an effects-based approach does not necessarily reduce the enemy air defense threat to CAS. Where the effects-based approach may have an advantage compared to the objective-based one is in innovative solutions to creating effects that achieve objectives, especially where those solutions reduce the risk of CAS air exposure to enemy air defenses.

Returning again to the chapter 2 example, the effects-based restating of that EFST is shown here:

1. Objective: Allow 2nd BN to advance to phase line Smith.
2. Effect: Disrupt movement of 3rd Guards Tank Regiment.

MOE: 2-69 Armor secures Brown Pass NLT 1400L.

3. Node: Tanks of the 3rd Guards Tank Regiment.
4. Action (Task): Engagement.

MOP: 8–10 vehicles destroyed vicinity Brown Pass

5. Causal Linkage (Mechanism): Slows enemy tank movement; diverts enemy attention and effort.
6. Resource: CAS assets.

The previous example is a presentation of the JP 3-09.3 objective-based CAS EFST in an effects-based way. But the key to an effects-based approach is the desired *effect* and the resulting analysis of enemy systems that reveals multiple ways to cause that effect and minimize or avoid unintended ones. In the example, an effects-based analysis might reveal other options to disrupt the movement of the 3rd Guards Tank Regiment such as mines on its axis of advance, interdiction of its fuel supply, or cratering its axis of approach, if 3rd Guards is using a road for its advance. These options may cause the node, action, causal linkage, and maybe even the resource to change as a result of enemy analysis and development of options to create the desired effect. Each of the options shown also presents a significantly reduced risk to CAS assets from enemy air defenses since CAS is not directly engaging enemy surface forces.

Execution Criterion 3. Are the minimum required actions applied to achieve the desired effects or conditions?

Execution Criterion 3 -- Objective-based

This approach carries with it the possibility of resource waste due to overmatching CAS air to fire support element identified EFSTs. From the chapter 2 example the question that arises is whether or not using CAS for disruption of tank movement is the most economical use of valuable and limited air assets. Certainly another fire support system, such as artillery or mortars, can accomplish the task of “disrupting movement” and can achieve it with less coordination, time, money, and risk than CAS, thereby freeing those assets for a higher impact task commensurate with the effort and expense necessary to employ them.

The objective-based approach tends to overkill typical organic fires tasks and targets with expensive and time-consuming CAS that could be more effectively applied elsewhere in the AO.

Execution Criterion 3 -- Effects-based

An effects-based approach requires fire support and CAS planners to consider objectives in terms of the effects required to achieve them. In the modified effects-based example the supported ground unit’s objective is “2nd BN advances to Phase Line Smith.” The example lists one desired or required effect to facilitate this objective, “disrupt movement of the 3rd Guards Tank Regiment,” although there could be more than one effect in this instance that would contribute to achievement of the objective and end state. This type of thinking forces planners to explore as many options as time and

circumstance allow, not only effectively accomplishing the mission but also completing it efficiently.

One of the questions that may be posed is does the effect of disruption best facilitate the accomplishment of the stated objective of “2nd BN advancing to Phase Line Smith?” An answer to this question would be based on factors affecting the example’s tactical problem. While the full parameters of the tactical situation have not been provided, it is apparent that more than one joint effect on the enemy or joint tactical task (as defined in chapter 2) might accomplish the mission and objective with equal efficacy. The effects or tactical mission tasks of destroy, delay, harass, deceive, neutralize, and fix might all accomplish the objective as well as disruption, and may allow for greater economy of force or less unacceptable consequences.

Whichever effect is determined most desirable, the nodes or links identified for action (targeting and tasking) could also be different than “tanks of the 3rd Guards Tank Regiment.” Other nodes or links might include canalized terrain, 3rd Guards Tank Regiment command and control, 3rd Guards logistics, 3rd Guards personnel morale, and 3rd Guards command perceptions.

Effects-based planners might even consider disregarding the enemy force altogether by looking at nodes, links, actions, and resources in regard to 2nd BN’s ability to more quickly advance to Phase Line Smith ahead of the approaching enemy force. This would preserve joint combat power for later operations.

Regardless of the direction in which planning proceeds, the effects-based approach helps planners analyze the best effect or effects to achieve objectives and then continue to analyze the most applicable nodes (targets), actions (tasks), and resources to

create those effects. In the resource-constrained contemporary operating environment an effects-based approach helps applies the minimum required effort to achieve the desired effects or conditions.

Execution Criterion 4. Is it flexible?

Execution Criterion 4 -- Objective- and Effects-based

Changes during CAS missions can be numerous due to the fluid nature of the ground battle and the supported force's scheme of maneuver. Both approaches to CAS execution are adaptive to changes from both the ground and airborne operator perspectives due to consistent training for rapidly changing tactical environments.

The key to evaluating this criterion is whether or not the approach contributes to meeting the supported ground commander's intent once mission changes force flexible responses. The answer lies with how well the intent has been communicated and internalized by CAS operators on the ground and in the air.

The arguments regarding this criterion are virtual mirror-images of those under Planning Criterion 3. Both approaches are flexible in terms of responsiveness to change, and both have the same reasonable chance of communicating supported commander's intent to the appropriate forward JTAC or airborne CAS asset. Given similar flexibility and communication of intent, the only remaining discriminator is quality of intent.

Effects-based planning formulates an intent better constructed to effectively accomplish the supported surface unit's mission by specifying effects as conditions that lead to the supported commander's desired end state. The objective-based approach lists those conditions as key tasks that are essential to accomplish the mission but do not necessarily contribute directly to realization of the envisioned end state. Of important

note here is the distinction again between mission accomplishment and improved achievement of commander's intent. A JTAC or FAC(A) with a firm grasp of supported commander's intent shaped in the form of conditions designed to contribute to desired end states is best able to respond flexibly to situational changes and still operate most efficiently within the commander's intent.

Execution Criterion 5. Does it provide desired effects or establish key conditions?

#### Execution Criterion 5 -- Objective-based

The objective-based answer for this criterion is a simple and straightforward no. Virtually nowhere within the current objective-based CAS doctrine is there discussion of effects or conditions that contribute to realization of the supported commander's envisioned end state. The term effect is present in the TPME format of CAS EFSTs, but in that context simply represents the end result of a fire support task and not a required condition supporting a desired end state.

#### Execution Criterion 5 -- Effects-based

This approach offers the essential links between objectives and tasks missing in the objective-based methodology. Effects, nodes, actions, and resources are identified after developing the mission and objectives. Development and exposition of effects are important analytical steps absent from objective-based thinking, planning, and execution.

### Assessment

Assessment Criterion 1. Does it provide timely, accurate evaluation of execution results?

### Assessment Criterion 1 -- Objective and Effects-Based

Both approaches provide timely evaluation of execution results; the issue is accuracy. CAS employs lethal firepower against physical targets usually under the direct observation of trained and qualified ground observers or attack controllers. These forward observers or ground controllers assessed the immediate results of CAS attacks, or conducted the physical and functional subcomponents of BDA. These observers typically had no formal training in the assessment of battle damage.

JTACs and FAC(A)s execute this responsibility today, but likewise have virtually no formal training in BDA. The idea behind both physical and functional assessments in the field is reporting what is seen (Buryanek 2005), but there are dangerous pitfalls for the untrained observer. Ground commanders trust the BDA judgments made by their air liaisons and JTACs, (Buryanek 2005) as well as by supporting FAC(A)s and CAS strikers. These individuals all make the best assessments they can, but are often unable to determine whether or not ordnance even struck a target, much less the actual result achieved. Some situations are obvious, such as an AGM-65D Maverick air-to-surface missile attack on a tank that results in a fiery explosion followed by tank parts and the turret flying into the air. Unfortunately, results from a great many CAS attacks are neither so spectacular nor so final.

Despite the best intentions of most CAS operators, BDA has historically been over-estimated (Walker 1998, 27), often due to the physical limitations of human sight and the technological limitations of sensors. Unfortunately, the promise of operational net assessment may not extend down to the tactical levels most often associated with BDA, especially the fairly immediate physical and functional determinations. ONA is less

developed and doctrinally inculcated than even EBO and will undoubtedly undergo numerous refinements prior to finding its way into future doctrine and battlefields. In the meantime, improvements in real-time, tactical BDA will be accomplished incrementally through increased assessment training for operators and observers and improved sensor capabilities. Both objective- and effects-based approaches provide timely BDA, but neither is the final solution to the need for accurate BDA.

Assessment Criterion 2. Does it allow for a timely, correct re-attack decision?

Assessment Criterion 2 -- Objective-based

It is in this criterion where the objective-based approach to BDA begins to fall short of the effects-based one especially in the area of target system assessment. Target system assessment is the final step in the doctrinal three-step BDA process. This assessment determines the overall result of an attack on the enemy system, not just on an individual target (for example, a tank) but on an entire target system under attack (a tank column or formation). That determination, along with munitions effectiveness assessment (MEA), is used to make the final overall combat assessment (CA) and determine whether or not a re-attack of the target or targets is necessary.

MEA is typically conducted after the end of combat activities so that the effects of the munitions used on the target or targets can be evaluated. Because it occurs after the engagement, MEA is not useful for assessing CAS while in the fight.

In regard to a re-attack determination, the CA process (figure 16) was developed with an air interdiction targeting mindset. This involves one pre-planned attack or set of attacks against a fixed target or targets, then a return to base. Following mission completion as full an assessment of combat effectiveness as possible is conducted before

a decision is made regarding a re-attack. This process, from launch of the air interdiction mission through CA of the attack and determination of a re-attack could take several days. The fleeting nature of a fluid, often mobile, CAS battlefield usually precludes targeting and assessment cycles that run for several days, but rather requires making judgments and decisions within hours or minutes. It is common practice for re-attack decisions to be made immediately following a CAS attack with the flight or asset that just attacked being directed to a re-attack if the results of the first strike were not satisfactory.

The objective-based approach supports a timely re-attack decision, sometimes within a few minutes, as well as the effects-based approach. However, the objective-based approach focuses the re-attack decision solely on the task or target presented by the CAS EFST from the operations order's intent for fires. Since the effect delineated in the TPME format of the CAS EFST is often incorrectly written as an empirical metric (from the chapter 2 example: "CAS destroys 8-10 vehicles vicinity of Brown Pass") the objective-based approach is almost invariably directs a re-attack due to inadequate target hit or miss determination, not enough targets being hit to meet the quantity specified in the CAS EFST, or the controller simply having no further tasking available for his air assets but not wanting to "waste CAS." The TPME format of CAS EFSTs reduces the entire conduct of CAS to a targeting exercise because the effect "attempts to quantify the successful accomplishment of the task," (JP 3-09.3 Chg 1 2005, III-9 and -10) instead of defining the "physical and/or behavioral state of a [target] system," (JWFC 2004, 11) or conditions contributing to the commander's intent and desired end state.

An incorrect re-attack decision could result in attacking valid targets that contribute little to the overall mission or in CAS aircraft shot down or damaged due to

over-exposure to enemy air defenses. In the end, the objective-based approach allows for a timely, but not always correct, re-attack decision.

#### Assessment Criterion 2 -- Effects-based

The effects-based approach to re-attack decisions is not the ultimate solution, but does have distinct advantages over the objective-based approach in that it directs attacks and re-attacks more consistent with commander's intent.

This approach focuses on effects rather than tasks or targets. ALO and JTAC understanding of the CAS role in achieving the conditions leading to the commander's desired end state and planning to help realize those conditions goes a long way to making targeting and re-attack decisions consistent with that intent. Consider again the effects-based CAS EFST example.

Of particular note from the example is the effect of "disrupting movement of the 3rd Guards Tank Regiment" and its accompanying MOE of "2-69 Armor securing Brown Pass NLT 1400L." With CAS players using EFSTs in this format an entirely different emphasis is placed on the use and re-use of CAS. Attacks and re-attacks are determined solely on the basis of whether or not they will assist achievement of the desired effect contributing to the ground unit objective or whether or not that effect has already been achieved and other CAS EFSTs can be pursued. For example, in the objective-based EFST, 8-10 tanks were to be destroyed to disrupt the 3rd Guards advance. Since it is unlikely any single CAS attack or set of attacks from a flight could destroy 8 tanks in a single pass, re-attack is a virtual certainty. While there is little doubt that destruction of 8-10 tanks will disrupt the 3rd Guards movement, there are other actions that will achieve disruption and cost less in terms of weapons expended, CAS

exposed, and time spent. Examples of other possible actions were listed in Execution Criterion 3. What is important to note with regard to the current criterion is that concentration on the effect contributing to the objective from the outset creates a favorable situation for conducting CAS attacks and re-attacks that aids in setting the conditions necessary to achieve the envisioned end state.

Assessment Criterion 3. Does it facilitate improvement of TTP and capability through timely, accurate determination of overall CAS mission effectiveness and efficiency?

#### Assessment Criterion 3 -- Objective-based

CAS missions, like the ground missions they support, are constantly critiqued through various after action reviews. One of the consistent lessons from these after action reviews is the disconnect between successful attack of targets by CAS and support of the commander's intent. The Joint Close Air Support Joint Test and Evaluation conducted in 2002 determined that aircraft engage the desired target in 99 percent of CAS attacks, but the desired end state is met in only 31 percent of the battles (6th Combat Training Squadron 2005, slides 36 and 37). This data leads suggests that current CAS procedures do not support the commander's intent and may not even consistently contribute to accomplishment of the overall mission. While that may be overstate the seriousness of the current state of affairs, it underlines the need for greater focus on end state conditions in current joint CAS planning and execution.

This focus on CAS planning and execution to meet commander's intent is being taught at the Joint Firepower Course and Air Liaison Officer Qualification Course at the Joint Air-to-Ground Operations Group, Nellis Air Force Base, Nevada. Those programs

mesh a CAS decision-making process with the JP 3-09.3 planning model, the Army's military decision making process, and the Marine Corps planning process (Buryanek 2005). But the course is required to limit the training to current doctrine and TTP which is a purely strategy-to-task or objective-to-task methodology that can overlook or obscure the end state conditions set forth in the commander's intent.

Thus, it is not the objective-based CAS process that prevents achievement of commander's intent but rather an approach that lacks focus on effects or conditions required to meet the end state described in that intent. The objective-based approach has all the elements necessary to improve upon future missions, doctrine, TTP, and capability, but the extent of improvement is limited by the deficiencies in the methodology's structure.

#### Assessment Criterion 3 -- Effects-based

An effects-based approach to CAS also includes after action reviews as seen in the current objective-based approach. The difference is in the assessment of mission efficiencies. In this area the effects-based approach should show a marked improvement over the objective-based approach with regard to support of the commander's intent and achieving the desired end state.

The effects-based approach is fundamentally designed to identify and consistently focus on effects or conditions contributing to the desired end state. These conditions, known as key tasks in current doctrine, are often diluted in the objective-based approach by the emphasis on tasks rather than on effects that support objectives and create envisioned end states.

EBO speaks to the limited or constrained resource environment the joint force currently finds itself in by offering a way to accomplish the mission and do so in an economical way that preserves combat power and resources. Effects-based thinking is not perfect or foolproof but does focus planners, operators, and assessors on the critical aspects of the mission -- the effects needed to achieve objectives and realize the commander's desired end state.

Table 5. Objective- Versus Effects-Based CAS Comparison Matrix

Evaluation Criteria	Objective-based Approach	Effects-based Approach
<b>Planning</b>		
1. Accurately determines conditions (effects) required to achieve the desired end state	—	+
2. Does it contribute to friendly understanding of the enemy system?	—	+
3. Do CAS players receive and internalize commander's intent?	+/-	
<b>Execution</b>		
1. Is it timely?	+/-	
2. Does it minimize exposure of CAS air assets to enemy threat systems?	—	+
3. Are the minimum required actions applied to achieve the desired effects or conditions?	—	+
4. Is it flexible?	+/-	
5. Does it provide desired effects or establish key conditions?	—	+
<b>Assessment</b>		
1. Does it provide timely, accurate evaluation of execution results?	+/-	
2. Does it allow for a timely, correct re-attack decision?	+/-	
3. Does it facilitate improvement of TTP and capability through timely, accurate determination of overall CAS mission effectiveness and efficiency?	—	+

## Summary

This chapter analyzed the thesis primary research question: can an effects-based approach to the conduct of joint CAS improve achievement of the supported ground commander's intent? It accomplished this through the qualitative comparison methodology described in chapter 3. Each approach to the conduct of joint CAS was compared and evaluated in turn, with a summary of results presented in Table 5.

The final thesis chapter answers the thesis primary question, draws further conclusions in reference to effects-based joint CAS, and makes recommendations for the future of effects-based approaches to joint CAS and further research on the subject.

## CHAPTER 5

### CONCLUSION AND RECOMMENDATIONS

#### Overview

This chapter answers the thesis primary question in the form of a conclusion, provides recommendations based on that conclusion, and provides recommendations for further research into effects-based approaches and joint CAS.

#### Thesis Conclusion

The thesis primary question is: can an effects-based approach to the conduct of joint CAS improve achievement of the supported ground commander's intent? Branches from this question are: (1) if yes, then how? (2) if not, then why not?

The analysis in chapter 4, summarized graphically in Table 5., reveals that an effects-based approach to the conduct of joint CAS *can* improve achievement of the supported ground commander's intent. The next question is how? The current objective-based approach to joint CAS has been effective in the past and has served the joint force well, especially in recent conflicts (Kirkpatrick 2004, 1). The question presented by this thesis has never been whether joint CAS works, but rather, if an effects-based approach can make it work better.

An effects-based approach improves joint CAS assistance in achieving the ground commander's intent though the evolution and improvement of existing operational design theory, doctrine, and procedures. The effects-based approach is not revolutionary. Effects-based ideas have existed for many years, but their implementation has often been limited by technology or capability. The technical advances of the last half-century,

combined with a rethinking of many traditional approaches to warfare, have led to an appreciation of a need for effects methodology within the current objective-based US operational design framework.

Much of the resistance to effects-based thinking has centered on the idea that EBO is simply a repackaging of current ideas and terms, such as “effects” for “objectives” or “targets” (Army Futures Center 2006, slide 22). Some of this frustration has been due to a tendency for military theorists to characterize EBO as revolutionary or a revolution in military affairs all its own (Deptula 2001). EBO and effects-based approaches are neither so trivial nor so monumental; they are simply an improved way of thinking about and focusing on desired end states throughout the conduct of an operation.

The improvements brought about by an effects-based approach are compatible with the existing joint CAS objective-based approach and should not supplant current doctrine and methodology. Instead an effects-based approach provides improved focus on the conditions required to meet the supported ground commander’s desired end state expressed in his intent.

An effects-based approach is currently being incorporated into Joint Publications 3-0 and 5-0 (FM 3-0 Issue Paper #2, 11). The incorporation of EBO into these documents will likely be subtle, an evolution of current proved doctrine. These rewrites will then drive changes in subordinate joint publications such as JP 3-09 (Joint Fire Support) and JP 3-09.3 (Joint CAS).

#### Recommendations Based on the Thesis Conclusion

As EBO and effects-based theories become doctrinal reality within the joint community’s keystone documents, a rewrite of joint and multi-service CAS doctrine (JP

3-09.3 and J-FIRE) will necessarily follow. Recommendations for the incorporation of an effects-based approach into joint CAS doctrine, training, and execution include:

1. Emphasize the value of effects-based thinking especially in planning and preparation. This includes air liaison personnel being fully involved in the mission analysis for fire support and the development of EFSTs that may then become CAS EFSTs. This should also include a discussion of possible tasks and effects for CAS beyond “attack to destroy.” Also needed is an increased discussion of intelligence preparation of the battlefield that analyzes enemy forces through a systems approach to identify critical nodes for effects and targeting.

2. Change the format of CAS essential fire support tasks (EFSTs) from TPME to the following: Objective, Effect (plus Measure of Effectiveness), Target, Task (plus Measure of Performance), Causal Linkage, Resource, and rewrite in JP 3-09.3 as:

- a. Objective: 2nd BN seizes Brown Pass NLT 01April20071400L.
- b. Effect: 3rd Guards Tank Regiment disrupted enroute to Brown Pass.

MOE: Number of enemy vehicles slowed or stopped prior to engagement of friendly forces enroute to Brown Pass.

- c. Target: Tanks of the 3rd Guards Tank Regiment.
- d. Task: Attack to disrupt.

MOP: Enemy movement and timetable slowed such that they’re unable to engage 2nd BN prior to its seizure of Brown Pass.

- e. Causal Linkage: Slows enemy tank movement; diverts enemy attention and effort.
- f. Resource: Fixed-wing CAS assets (4 x F-15Es).

3. Emphasize (as in the EFST example above) that the Objective is often derived from a supported ground commander's mission statement and that more than one Effect, and therefore more than one EFST, may be applied to a given Objective.

4. Highlight the requirement for CAS crews to receive unit mission and commander's intent for the lowest echelon expected to be supported prior to takeoff. Also add Commander's Intent to the CAS planning checklist in the appendices of JP 3-09.3.

5. Change the Situation Update in JP 3-09.3 to include Unit Mission and Commander's Intent as one of the checklist items. Change J-FIRE's Situation Update to the exact same format presented in the updated JP 3-09.3.

6. Add an explanation of the Unit Mission and Commander's Intent item in the Situation Update that reads: "Unit mission should be an abbreviated mission statement of the actual echelon being supported by the CAS. Commander's intent should be a concise statement of the lowest echelon supported commander's desired end state and conditions necessary to achieve the end state if those conditions can be created by the CAS assets on station. This information is provided to allow CAS crews the ability to operate flexibly and creatively within the commander's intent in an effort to achieve his desired end state as effectively and efficiently as possible."

7. Along with recommendation 6. add the idea that if a FAC(A) is on station the JTAC should provide Unit Mission and Commander's Intent only to him, allowing the FAC(A) to determine what information is necessary to provide to supporting CAS strikers.

8. Expand on the discussion of BDA to include assessment of the CAS effort in terms of conditions or effects achieved in support of commander's intent and not simply a determination of targeting results.

9. Add discussion of CAS re-attack decisions being driven by achievement of desired effects and not just successful engagement of chosen targets.

10. CAS schoolhouses and the Joint CAS Executive Steering Committee need to incorporate JTAC, air liaison, and FAC(A) BDA training into formal certification programs and periodic qualification and currency requirements.

11. Include a discussion on CAS after action review that focuses on effects created in support of commander's intent and how and why those effects assisted in ground unit mission success or failure rather than numbers of targets successfully engaged, numbers of sorties flown, or amount of ordnance employed.

12. Once the above recommendations have been incorporated into doctrine and formal training, CAS operator certification, qualification, currency, and evaluation programs should emphasize effects-based CAS conduct in training and combat.

#### Recommendations for Further Research

This thesis has revealed numerous areas where further research into effects-based approaches to joint CAS is needed:

1. How to model an enemy fielded force and apply a system of systems analysis to it.
2. How to teach effects-based targeting that connects objectives to tasks through effects and causal linkages.

3. What are the historical or scientific bases for determining the psychological and systemic effects of lethal and non-lethal CAS attacks and battlefield presence on enemy forces?

4. How to improve real-time assessment of CAS effects on the battlefield to maximize the impact and efficient utilization of CAS assets.

5. As effects-based CAS begins to be executed, what are the results compared to the objective-based approach and what improvements can be suggested by that analysis?

6. What is the utility of Commander's Intent received by CAS aircrews while airborne and does that information improve or inhibit mission effectiveness or efficiency?

7. Ways to improve written commander's intent and dissemination of that intent.

### Summary

The final chapter answered the thesis primary question, provided recommendations based on that conclusion, and recommendations for further research into effects-based joint CAS. Joint CAS has been and continues to be successful. Ultimately, it is the responsibility of all CAS professionals to attempt to improve the efficiency and overall conduct of the mission. This thesis has attempted that by exploring the application of EBO to current joint CAS processes to ensure CAS continues to effectively and efficiently assist those for which it exists: the ground and surface forces of the US and her multi-national partners.

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